Rexroth Bosch Group

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# 1 Important Notes

## 1.1 Symbols

The symbols in this document are used to draw your attention on notes and dangers.

### 1.1.1 General Symbols

**Danger**
This symbol is used to refer to instructions which, if ignored or not carefully followed could result in personal injury.

**Note**
This symbol indicates application tips or supplementary notes.

**Reference to source of information**
This symbol refers to detailed sources of information on the current topic.

## 1.2 Target Group

All configuration and programming work in connection with the automation system must be performed by trained personnel only (e.g. qualified electricians, electrical engineers)

The configuration and programming personnel must be familiar with the safety concepts of automation technology.

Important Notes

# 2 Important Directions for Use

## 2.1 Appropriate Use

### 2.1.1 Introduction

Rexroth products represent state-of-the-art developments and manufacturing. They are tested prior to delivery to ensure operating safety and reliability.

The products may only be used in the manner that is defined as appropriate. If they are used in an inappropriate manner, then situations can develop that may lead to property damage or injury to personnel.

Bosch Rexroth, as manufacturer, is not liable for any damages resulting from inappropriate use. In such cases, the guarantee and the right to payment of damages resulting from inappropriate use are forfeited. The user alone carries all responsibility of the risks.

Before using Rexroth products, make sure that all the pre-requisites for appropriate use of the products are satisfied:

- Personnel that in any way, shape or form uses our products must first read and understand the relevant safety instructions and be familiar with appropriate use.
- If the product takes the form of hardware, then they must remain in their original state, in other words, no structural changes are permitted. It is not permitted to decompile software products or alter source codes.
- Do not mount damaged or faulty products or use them in operation.
- Make sure that the products have been installed in the manner described in the relevant documentation.

### 2.1.2 Areas of Use and Application

The VCP-operating concept contains hardware and project planning software that allows to operate and control machines and installations and serves to visualize the information about the machine/installation to be operated required by the user.

Operation is only permitted in the specified configurations and combinations of hardware components and with the software and firmware specified in this documentation and in the relevant project planning manuals.

Typical applications are:

- Handling and assembly systems
- Packaging and foodstuff machines
- Printing and paper processing machines
- Machine tools

## 2.2 Inappropriate Use

Applying the hardware and project planning software used in combination with the VCP operating concept outside of the above-referenced areas of application or under operating conditions other than described in the document and the technical data specified is defined as "inappropriate use".

The hardware and project planning software may not be used, if

- they are subject to operating conditions that do not meet the above specified ambient conditions.
- Bosch Rexroth has not specifically released them for that intended purpose. Please note the specifications outlined in the general Safety Guidelines!

# 3 Safety Instructions for Electric Drives and Controls

## 3.1 Introduction

Read these instructions before the initial startup of the equipment in order to eliminate the risk of bodily harm or material damage. Follow these safety instructions at all times.Do not attempt to install or start up this equipment without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. If you do not have the user documentation for your equipment, contact your local Bosch Rexroth representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment. If the equipment is resold, rented or transferred or passed on to others, then these safety instructions must be delivered with the equipment.

**WARNING**
**Improper use of this equipment, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in material damage, bodily harm, electric shock or even death!**

## 3.2 Explanations

The safety instructions describe the following degrees of hazard seriousness in compliance with ANSI Z535. The degree of hazard seriousness informs about the consequences resulting from non-compliance with the safety instructions.

| Warning symbol | Signal word and degree of hazard seriousness according to ANSI |
|---|---|
| | **DANGER**<br>Death or severe bodily harm will occur. |
| | **WARNING**<br>Death or severe bodily harm may occur. |
| | **CAUTION**<br>Bodily harm or material damage may occur. |

Fig. 3-1: Hazard classification (according to ANSI Z535)

## 3.3 Hazards by Improper Use

**DANGER**
High voltage and high discharge current! Danger to life or severe bodily harm by electric shock!

**DANGER**
Dangerous movements! Danger to life, severe bodily harm or material damage by unintentional motor movements!

**WARNING**
High electrical voltage due to wrong connections! Danger to life or bodily harm by electric shock!

**WARNING**
Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

**CAUTION**
Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!

**CAUTION**
Risk of injury due to improper handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock or incorrect handling of pressurized systems!

**CAUTION**
Risk of injury due to incorrect handling of batteries!

## 3.4 General Information

- Bosch Rexroth AG is not liable for damages resulting from failure to observe the warnings provided in this documentation.
- Read the operating, maintenance and safety instructions in your language before starting up the machine. If you find that you cannot completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Only persons who are trained and qualified for the use and operation of the equipment may work on this equipment or within its proximity.

- Furthermore, they must be trained, instructed and qualified to switch electrical circuits and equipment on and off in accordance with technical safety regulations, to ground them and to mark them according to the requirements of safe work practices. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The equipment is designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Use only safety features and applications that are clearly and explicitly approved in the Project Planning Manual.
- For example, the following areas of use are not permitted: construction cranes, elevators used for people or freight, devices and vehicles to transport people, medical applications, refinery plants, transport of hazardous goods, nuclear applications, applications sensitive to high frequency, mining, food processing, control of protection equipment (also in a machine).
- The information given in the documentation of the product with regard to the use of the delivered components contains only examples of applications and suggestions.

The machine and installation manufacturer must

- make sure that the delivered components are suited for his individual application and check the information given in this documentation with regard to the use of the components,
- make sure that his application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Startup of the delivered components is only permitted once it is sure that the machine or installation in which they are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only permitted if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the documentation "EMC in Drive and Control Systems".
- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

The machine or installation manufacturer is responsible for compliance with the limiting values as prescribed in the national regulations.

- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

## 3.5 Protection Against Contact with Electrical Parts

This section refers to equipment and drive components with voltages above 50 Volts.

Touching live parts with voltages of 50 Volts and more with bare hands or conductive tools or touching ungrounded housings can be dangerous and cause electric shock. In order to operate electrical equipment, certain parts must unavoidably have dangerous voltages applied to them.

**DANGER**
**High electrical voltage! Danger to life, severe bodily harm by electric shock!**

- Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.
- Follow general construction and safety regulations when working on high voltage installations.
- Before switching on power the ground wire must be permanently connected to all electrical units according to the connection diagram.
- Do not operate electrical equipment at any time, even for brief measurements or tests, if the ground wire is not permanently connected to the points of the components provided for this purpose.
- Before working with electrical parts with voltage higher than 50 V, the equipment must be disconnected from the mains voltage or power supply. Make sure the equipment cannot be switched on again unintended.
- The following should be observed with electrical drive and filter components:

Wait five (5) minutes after switching off power to allow capacitors to discharge before beginning to work. Measure the voltage on the capacitors before beginning to work to make sure that the equipment is safe to touch.

- Never touch the electrical connection points of a component while power is turned on.
- Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.
- A residual-current-operated protective device (RCD) must not be used on electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.
- Electrical components with exposed live parts and uncovered high voltage terminals must be installed in a protective housing, for example, in a control cabinet.

To be observed with electrical drive and filter components:

**DANGER**
**High electrical voltage on the housing! High leakage current! Danger to life, danger of injury by electric shock!**

- Connect the electrical equipment, the housings of all electrical units and motors permanently with the safety conductor at the ground points before power is switched on. Look at the connection diagram. This is even necessary for brief tests.
- Connect the safety conductor of the electrical equipment always permanently and firmly to the supply mains. Leakage current exceeds 3.5 mA in normal operation.
- Use a copper conductor with at least 10 $mm^2$ cross section over its entire course for this safety conductor connection!
- Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. Otherwise, high voltages can occur on the housing that lead to electric shock.

## 3.6 Protection Against Electric Shock by Protective Low Voltage (PELV)

All connections and terminals with voltages between 0 and 50 Volts on Rexroth products are protective low voltages designed in accordance with international standards on electrical safety.

**WARNING**
**High electrical voltage due to wrong connections! Danger to life, bodily harm by electric shock!**

- Only connect equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) to all terminals and clamps with voltages of 0 to 50 Volts.
- Only electrical circuits may be connected which are safely isolated against high voltage circuits. Safe isolation is achieved, for example, with an isolating transformer, an opto-electronic coupler or when battery-operated.

## 3.7 Protection Against Dangerous Movements

Dangerous movements can be caused by faulty control of the connected motors. Some common examples are:

- improper or wrong wiring of cable connections
- incorrect operation of the equipment components
- wrong input of parameters before operation
- malfunction of sensors, encoders and monitoring devices
- defective components
- software or firmware errors

Dangerous movements can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitoring in the drive components will normally be sufficient to avoid faulty operation in the connected drives. Regarding personal safety, especially the danger of bodily injury and material damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.

**DANGER**

**Dangerous movements! Danger to life, risk of injury, severe bodily harm or material damage!**

- Ensure personal safety by means of qualified and tested higher-level monitoring devices or measures integrated in the installation. Unintended machine motion is possible if monitoring devices are disabled, bypassed or not activated.

**Pay attention to unintended machine motion or other malfunction in any mode of operation.**

- Keep free and clear of the machine's range of motion and moving parts. Possible measures to prevent people from accidentally entering the machine's range of motion:

– use safety fences
– use safety guards
– use protective coverings
– install light curtains or light barriers

- Fences and coverings must be strong enough to resist maximum possible momentum, especially if there is a possibility of loose parts flying off.
- Mount the emergency stop switch in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the machine if the emergency stop is not working.
- Isolate the drive power connection by means of an emergency stop circuit or use a starting lockout to prevent unintentional start.
- Make sure that the drives are brought to a safe standstill before accessing or entering the danger zone. Safe standstill can be achieved by switching off the power supply contactor or by safe mechanical locking of moving parts.
- Secure vertical axes against falling or dropping after switching off the motor power by, for example:

– mechanically securing the vertical axes

– adding an external braking/ arrester/ clamping mechanism

– ensuring sufficient equilibration of the vertical axes

The standard equipment motor brake or an external brake controlled directly by the drive controller are not sufficient to guarantee personal safety!

- Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection for:

– maintenance and repair work

– cleaning of equipment

– long periods of discontinued equipment use

- Prevent the operation of high-frequency, remote control and radio equipment near electronics circuits and supply leads. If the use of such equipment cannot be avoided, verify the system and the installation for possible malfunctions in all possible positions of normal use before initial startup. If necessary, perform a special electromagnetic compatibility (EMC) test on the installation.

## 3.8 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated near current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.

**WARNING**
Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

- Persons with heart pacemakers, hearing aids and metal implants are not permitted to enter the following areas:
  - Areas in which electrical equipment and parts are mounted, being operated or started up.
  - Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.
- If it is necessary for a person with a heart pacemaker to enter such an area, then a doctor must be consulted prior to doing so. Heart pacemakers that are already implanted or will be implanted in the future, have a considerable variation in their electrical noise immunity. Therefore there are no rules with general validity.
- Persons with hearing aids, metal implants or metal pieces must consult a doctor before they enter the areas described above. Otherwise, health hazards will occur.

## 3.9 Protection Against Contact with Hot Parts

**CAUTION**
**Housing surfaces could be extremely hot! Danger of injury! Danger of burns!**

- Do not touch housing surfaces near sources of heat! Danger of burns!
- After switching the equipment off, wait at least ten (10) minutes to allow it to cool down before touching it.
- Do not touch hot parts of the equipment, such as housings with integrated heat sinks and resistors. Danger of burns!

## 3.10 Protection During Handling and Mounting

Under certain conditions, incorrect handling and mounting of parts and components may cause injuries.

**CAUTION**
**Risk of injury by incorrect handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock!**

- Observe general installation and safety instructions with regard to handling and mounting.
- Use appropriate mounting and transport equipment.
- Take precautions to avoid pinching and crushing.
- Use only appropriate tools. If specified by the product documentation, special tools must be used.
- Use lifting devices and tools correctly and safely.
- For safe protection wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.
- Never stand under suspended loads.
- Clean up liquids from the floor immediately to prevent slipping.

## 3.11 Battery Safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or material damage.

**CAUTION**
**Risk of injury by incorrect handling!**

- Do not attempt to reactivate discharged batteries by heating or other methods (danger of explosion and cauterization).
- Never charge non-chargeable batteries (danger of leakage and explosion).
- Never throw batteries into a fire.
- Do not dismantle batteries.
- Do not damage electrical components installed in the equipment.

Be aware of environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose batteries separately from other waste. Observe the legal requirements in the country of installation.

## 3.12 Protection Against Pressurized Systems

Certain motors and drive controllers, corresponding to the information in the respective Project Planning Manual, must be provided with pressurized media, such as compressed air, hydraulic oil, cooling fluid and cooling lubricant supplied by external systems. Incorrect handling of the supply and connections of pressurized systems can lead to injuries or accidents. In these cases, improper handling of external supply systems, supply lines or connections can cause injuries or material damage.

**CAUTION**
**Danger of injury by incorrect handling of pressurized systems!**

- Do not attempt to disassemble, to open or to cut a pressurized system (danger of explosion).
- Observe the operation instructions of the respective manufacturer.
- Before disassembling pressurized systems, release pressure and drain off the fluid or gas.
- Use suitable protective clothing (for example safety glasses, safety shoes and safety gloves)
- Remove any fluid that has leaked out onto the floor immediately.

Environmental protection and disposal! The media used in the operation of the pressurized system equipment may not be environmentally compatible. Media that are damaging the environment must be disposed separately from normal waste. Observe the legal requirements in the country of installation.

# 4 Application Description for Small Operator Terminals

## 4.1 The Concept

A uniform functionality and operating structure constitute key aspects of the operating and monitoring concept across the entire product family.

The small operator terminal of construction type VCP relieves the controller completely of operating and monitoring tasks.

This applies to the operating mode Standard Mode in particular. In this mode, devices reach their full performance capacity. In this context, the small-sized operating terminal reads all required data independently from the controller, and processes this further internally. On request, the device writes data or data sets (of recipes) to the controller. The device independently controls the display and the status LEDs.

You can also run the small operator terminal as an ANSI terminal in the operating mode Transparent Mode. In this context, the device writes each key actuation to the controller as a press and release code. The controller uses escape sequences to control the display and the status LEDs of the device.

All small operator terminals of construction type VCP are programmed in the same way using the programming software VI Composer.

### 4.1.1 Uniform Device Features

All small operator terminals of the VCP model are equipped with:

- Displays with temperature-compensated contrast or brightness control
- Flash memory
- Buffered RAM
- Real-time clock
- Watchdog timer
- Lithium battery with voltage monitoring
- An interface for downloads, uploads, the logging printer, a scanner
- Standard or field bus interfaces for communication with the controller
- a user mode switch.

All small operator terminals with a keyboard are additionally equipped with:

- Editing keys
- Control keys

– Function keys with status LEDs
– Slide-in identification strips for the function keys

The operating system of all small operator terminals offers:

– The operating mode 'Standard Mode'
– Application ID
– Multilingual applications
– Option to customize the interface parameters
– Automatic error correction
– Softkey functionality for all function keys
– A help system for masks and variables
– Password protection function for masks and variables
– Scaling of variable values
– Dynamic attributes for texts and variables
– A message system for status messages
– A message system for error messages
– Recipe data management function
– Print logs
– Running time meters
– System variables for internal functions.

Small operator terminals with graphics displays additionally offer:

– Use of any Windows fonts
– Display of images
– Display of sets of curves.

Small operator terminals with a keyboard additionally offer:

– The operating mode 'Transparent Mode'

Small-sized operating terminals with a touch screen additionally offer:

– Full-graphics user interface including buttons
– A keyboard that is shown automatically when a variable is selected

## 4.2 Programming Small Operator Terminals

You program the small operator terminals of construction type VCP in the same way using the programming software VI Composer.

For this purpose, install the programming software on you PC.

- Start the software and select the corresponding entries for the device type and the desired communication protocol.
- Create all of the componentes of the project, consisting of languages and a controller.
- Compile the project into a S3 file and load the file into the operating device using the download cable.
- Connect the operating device to the controller or simulate the basic functions without a controller connected.

### 4.2.1 Hardware Prerequisites

To carry out the installation, you need a basic knowledge of Microsoft Windows. This information is not provided here. If you have any queries in this regard, refer to the Microsoft Windows manuals or online help.

**Hardware Requirements**

Your computer should fulfill the following hardware and software requirements, to run the programming software VI Composer:

- Pentium processor with 100 MHz (preferably 266 MHz)
- 32 MByte working memory (RAM) (preferably 64 MByte)
- 100 MByte free hard disk memory
- CD ROM drive
- Mouse
- Windows NT 4, Windows 95, Windows 98, or Windows 2000
- One free serial interface

## 4.2.2 Installing VI Composer

The installation of the programing software VI Composer includes all required directories, files and entries in Windows.

VI Composer runs under the operating systems Windows NT 4, Windows 95, Windows 98, Windows 2000, and Windows XP.

To install VI Composer, insert the installation CD, select the desired language and start the installation process. Follow the instructions in the installation dialog box.

# 5 Standard Mode

The small operator terminals are usually used in the Standard Mode of operation. The devices deliver maximum performance in this mode.

## 5.1 Setting the Operating Mode

Make sure that you set the operating mode when the device is switched off. This ensures that the device accepts the new operating mode.

Note the switch positions ON and OFF marked on the user mode switch. Depending on the user mode switch, the position of the switches may vary.

The factory setting for all operating devices is the Standard Mode of operation. You use the user mode switch to set the operating mode.

Refer to the user manual for the device for more information on the position of the user mode switch.

After you switch on the power supply, the switch position is only read and evaluated once, that is, during the initialization phase.

To set the user mode switch with four switches to the operating mode **Standard Mode**:

| Switch | Position |
|---|---|
| 1 | ON |
| 2 | OFF |
| 3 | OFF |
| 4 | OFF |

Fig. 5-1: User mode switch with four switches set to Standard Mode

If switch 1 is OFF the small operator terminal is in „Transparent Mode“. The „Transparent Mode“ is not described in this manual, because Rexroth applications do not use it, yet.

To set the user mode switch with eight switches to the operating mode **Standard Mode**:

| **Switch** | **Position** |
|---|---|
| 1 | ON |
| 2 | OFF |
| 3 | OFF |
| 4 | OFF |
| 5 | Not used |
| 6 | Not used |
| 7 | Not used |
| 8 | Not used |

Fig. 5-2: User mode switch with eight switches set to Standard Mode

To set the user mode switch with four switches to the operating mode **Demo Mode**:

| **Switch** | **Position** |
|---|---|
| 1 | ON |
| 2 | OFF |
| 3 | ON |
| 4 | OFF |

Fig. 5-3: User mode switch with four switches set to Demo Mode

To set the user mode switch with eight switches to the operating mode **Demo Mode**:

| **Switch** | **Position** |
|---|---|
| 1 | ON |
| 2 | OFF |
| 3 | ON |
| 4 | OFF |
| 5 | Not used |
| 6 | Not used |
| 7 | Not used |
| 8 | Not used |

Fig. 5-4: User mode switch with eight switches set to Demo Mode

Standard Mode

## 5.2 Behavior of the Operating Device During Start-Up

### 5.2.1 With Valid Project

When you apply the supply voltage, all LEDs on the operating device are activated. A system test is then carried out, to check and initialize the modules in the operating device.

The system test may issue different system and error messages. If the device contains a valid project, the **start-up mask** or the mask entered as the start-up mask in the language parameter is displayed. This mask is displayed five seconds. This time is set as a fixed value. You can use this time to check whether the LEDs and the display are functioning correctly.

Once this time has expired, the main mask, or the mask set as the main mask in the language parameters, is displayed. This mask is also the first mask of user interface.

If the main mask contains a controller variable, and communication with the controller fails, an error message is displayed (instead of the main mask), which provides details about the communication error that occurred.

If you press the Enter key or similar button while the start-up mask is being displayed, the setup mask or the mask set in the language parameters is displayed. In this mask, for example, parameters are assigned to the interfaces. If you press any key before the start-up mask appears, an error message is generated when the keyboard is being checked. The error message includes the data for clock frequency, memory size, firmware level, protocol driver, programming software version, and the project name.

The display of the setup mask may be delayed if the message memory contains several messages of the serial message system. This is because time may be required to set up message management structures. However, this initialization time considerably reduces the time subsequently required to sort messages. A corresponding message is displayed during this time period.

### 5.2.2 Without a Valid Project

If no valid project exists, the Flash memory is erased, and the operating device automatically switches to the download operating mode.

The message 'DOWNLOAD 1' remains on the screen. This message indicates that the operating device is now ready to receive a valid project via the download interface. If no valid project is available in the memory, there is no communication with a connected controller, and the keyboard will not execute any functions.

## 5.3 Communication with a Controller

Communication between a controller (host computer, for example) and an operating device may occur in standard mode with any interface, except those for the logging printer and parallel outputs. The interface used always depends on the connected counterpart or on the network.

For more information on the interfaces themselves, see the manual for the corresponding operating device.

More detailed information is available on possible connections to different controllers and networks.
See chapter “Controller and Bus Connections“ on page 6-1.

A standard cable, measuring about 3 m (9.843 ft), is available to ensure a secure connection for each connection option.

## 5.4 Masks

A mask refers to the content of a display page. This means that masks vary in size, depending on the operating device being used.

A mask corresponds to the screen displayed at a particular time on the screen of the operating device.

You can display and enter texts and variables (250) in input and output masks. You can determine the layout of these masks, and use images to tailor them to your specific requirements.

For each mask, you can program specific soft keys or function keys that will automatically link you to other masks. You can also program cursor keys to open other masks.

You can also program function keys to change the values of variables.

If you use the same mask names in all languages, you can use global mask elements to design similar masks. Global mask elements (for example, global variables) appear in each mask with the same name.

### 5.4.1 Mask Structure

Masks with specific functions form the basic components of the mask structure.

System masks:

- Setup mask
- Start-up mask
- Password mask
- Main mask

User mask:

- Input/output mask

The mask structure is made up of a network of input and output masks. There is no hierarchy. Input and output masks are located at nodes of the network. These masks contain a selection field from which you can choose the names of other masks.

In each input/output mask you can use control keys, function keys and buttons to access all other masks.

You can select different system masks for each language of a project.

## 5.4.2 Mask Parameters

Each mask parameter is valid for each individual mask of a project.

Mask parameters are:

- Mask number
- Access level
- Background color
- Help mask
- Variables management topdown
- Automatic data release
- Reset password
- Activate help mask

### 5.4.2.1 Mask Number

You can use the mask number to:

- Enter masks in a text list and display as a mask menu
- Switch masks over from the controller
- Write documentation for masks

### 5.4.2.2 Access Level

The access level corresponds to a threshold value for password management. You use it to determine when operators must enter a password.

Values between 0 and 255 are valid access level parameters.

The initial access level default value for each mask is 0. This corresponds to the status general release.

If the threshold value is above the view level, the operator can only display this mask if you enter the correct password.

If the threshold value is above the edit level, the operator can only change the variables contained in the mask if you enter the correct password.

### 5.4.2.3 Background Color

For each mask, you can select a separate color for the entire mask area. All elements that may be contained in a mask cover over the background color!

You can only use this parameter for operating devices that use gray scales or color display.

### 5.4.2.4 Help Mask

You can create a specific help mask for each mask, and display it by selecting the Help key or a corresponding button.

### 5.4.2.5 Variables Management Topdown

If you activate this parameter, the variables in a mask are selected in sequence from top to bottom.

If this parameter is not activated, the variables are selected from left to right.

### 5.4.2.6 Automatic Data Release

Switching to this mask automatically activates data release.

Otherwise you have to select the Data Release button to be able to change the value of a variable.

Automatic data release cannot be used with operating devices that use a touch screen.

### 5.4.2.7 Reset Password

Exiting this mask reactivates password protection. When you go back to this mask, you must enter your password again.

Standard Mode

### 5.4.2.8 Activate Help Mask

If you are using a touch-screen operating device, you can select the unused display area to display the help mask.

You cannot use the 'Activate Help Mask' parameter for operating devices equipped with a keyboard.

## 5.4.3 System Masks

System masks are based on the input/output mask type. Some restrictions apply, due to the compulsory initialization phase and the fact that no communication has yet taken place with the controller.

System masks facilitate programming, and allow the system to become directly operable. In this way, the initialization phase becomes a fixed component of the project.

You can select any mask as the system mask.

As all masks are created on a language-specific basis, you can define other masks as system masks for each language.

As no communication has yet been established with the controller during the initialization phase, the following restrictions apply to system masks.

- The setup mask and start-up mask cannot be accessed by selecting a mask externally
- No controller variables can be displayed on the setup mask and start-up mask

### 5.4.3.1 Setup Mask

The operator can only access the operating device's setup mask if you select the Enter key or the Setup button during the initialization phase (the start-up mask is displayed for five seconds).

On the setup mask, it may be useful to include the following functions:

- Activate/deactivate download function
- Set protocol parameters
- Select PLC protocol
- Set date and time
- Display firmware level of the operating device

If you program these functions using system variables, the operator can select the corresponding parameter from text lists.

### Password Protection for Setup Mask

A special procedure applies to password protection on the setup mask.

If you set the system variable MskchgPasswd as the first editable variable on the setup mask, you can enter the password independently of the access level (exception 255). This also allows you to set password protection for the setup mask.

For the setup mask, the access level only impacts at the edit level, meaning the content is always visible to the operator.

### Suppressing the Setup Mask

You can choose to hide the setup mask if you do not need to display it.

To do this, set the access level for this mask to the value 255. The setup mask can then not be accessed from the start-up mask (using the Enter key or the Enter button).

## 5.4.3.2 Start-up Mask

The start-up mask appears for about five seconds after you switch on the operating device. This time is fixed, and this cannot be changed.

On the start-up mask, you can only display static texts and system variables. Due to the time sequence used, it is not possible to enter variables here.

When the start-up mask is being displayed, you can press the Enter key to go to the setup mask. You cannot go to the setup mask if the access level of the setup mask is set to 255.

On the start-up mask, you can display the following information, for example:

- Service address
- Machine type
- Program version

### 5.4.3.3 Password Mask

In a project in which specific masks or variables are to be protected from unauthorized access, you must create a password mask.

In your password mask, you must create the system variable **MskchgPasswd**.

Select the name of the password mask in the language parameters, to activate the password mask.

You can create your own password mask for each language used in the project.

See chapter “Password Mask and Password Functions“ on page 5-138.
See chapter “MskChgPasswd“ on page 5-79.

## 5.4.4 Input/Output Masks

The user interface of a project is primarily made up of input and output masks. These masks may contain the following:

- Static text
- Text fields
- Variables
- System variables
- Background images
- Set of curves (graph)
- Buttons
- Recipe fields
- Table fields
- Message fields

You can also assign the following functions to an input/output mask:

- Sub-masks
- Help mask
- Background color
- Key functions (soft key function)

## 5.4.5 Help Masks

To optimize usability, you can create a help mask for each mask and each input variable. To call help on the operating devices, press the Help key or the button that has been programmed accordingly.

If data release is not requested, a help text appears for the screen. The help text for the variable that is currently selected appears, provided the Editor for entering a variable value has been activated.

The default help mask appears if no specific help mask has been linked to a mask or a variable.

A help mask is the same size as a normal mask. You can insert static text, background images, output variables, and tables in a help mask. You can also link help masks to sub-masks, to ensure that help masks have a uniform appearance.

See chapter “Password Mask and Password Functions“ on page 5-138.

## 5.5 Variables

All operating devices support standard usage variable types. The connected controller determines the number of variable types permitted.

The variable type determines the range of values and the number of significant places.

| Type | Size | Range of Values |
|---|---|---|
| Bit | 1 Bit | 0, 1 |
| Byte | 1 Byte | –128 to +127 |
| Byte | 1 Byte | 0 to 255 |
| Word | 2 Bytes | –32768 to +32767 |
| Word | 2 Bytes | 0 to 65535 |
| LWord | 4 Bytes | –2147483648 to +2147483647 |
| LWord | 4 Bytes | 0 to 4294967295 |
| LWord | 4 Bytes | ±1,2 x 10-38 to ±3,4 x 10+38 |
| ASCII | 42 Bytes | 0 to 255 |

Fig. 5-5: Variable types

In the programming software, you define a variable as a mask element. The mask element Variable is made up of the:

- Symbolic name
- Controller address
- Representation type
- Field type
- Field length
- Format
- Documentation value
- Limits
- Scaling
- Communication type
- Editor
- Variable type
- Attributes (static or dynamic)
- Character set
- Help mask

## 5.5.1 Symbolic Name

In the programming software, you assign a symbolic name to each variable. This name can have up to 255 characters.

## 5.5.2 Controller Address

You use the controller address to specify the storage location in the controller.

Note whether a variable will be accessed on a byte, word, or double-word basis.

Depending on the protocol selected, the system carries out a syntax check. To avoid incorrect input, you can call a syntax diagram for each protocol in the online help for the programming software.

## 5.5.3 Representation Type

You can choose from the following options for displaying variables on the operating device

- Decimal number
- Alphanumeric
- Selection text
- Selection image
- Floating point number
- Hexadecimal number
- Binary number
- Bars
- Curves

### 5.5.3.1 Decimal Number

#### Standard

The significance of the displayed digits increases from right to left. You can display places either with leading zeros and/or a decimal point. The representation refers to the data types bit, byte, word, and Lword. The maximum length depends on the data type. There are no blanks between the characters. The variable appears in the controller either in binary format or in special timer or counter formats.

Standard Mode

**Example:** A decimal number with two decimal places.

| $10^3$ | $10^2$ | $10^1$ | $10^0$ | $10^{-1}$ | $10^{-2}$ | Significance |
|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | Displayed = 123,45 |

| Key | Function |
|---|---|
| 0 to 9 | Enters the numbers 0 to 9. |
| Decimal point | Enters the decimal point. |
| Cursor Right | Moves the cursor one position to the right. |
| 0 to 9 | Enters the numbers 0 to 9. |
| Decimal point | Enters the decimal point. |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Plus | 1st case: Variable is selected. The value is deleted and you can enter a new value.<br>2nd case: Cursor was moved within a positive value. The value is not changed.<br>3rd case: Cursor was moved within a negative value. The negative sign for the value is deleted. |
| Minus | 1st case: Variable is selected. The value is deleted, and a negative sign is inserted at the least-significant position. You can enter a new value.<br>2nd case: Cursor was moved within a positive value. A negative sign is placed in front of the value.<br>3rd case: Cursor was moved within a negative value. The value is not changed. |
| Delete | Deletes the position where the cursor is located, and also deletes the sign. |

Fig. 5-6: Key functions for decimal numbers of the type Standard

## BCD Format

The significance of the displayed digits increases from right to left. You can display integers as BCD numbers with leading zeros.

The representation refers to the data types bit, byte, word, and Lword. The maximum length is 8 digits. There are no blanks between the characters. The variable appears in BCD format in the controller.

For one byte, the range of values spans from 00 to 99.

Example for a BCD number:

| $10^3$ | $10^2$ | $10^1$ | $10^0$ | $10^{-1}$ | $10^{-2}$ | Significance |
|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | Displayed = $1234_D$ |

It is important that you take particular care when inputting BCD numbers.

You can enter numeric values as standard decimal numbers using the Standard editor. You can also increment or decrement each individual digit of the BCD value using the Mixmode editor. You can only use the Increment editor to make incremental changes to individual digits in a value with decimal transfer. This corresponds to the procedure used by a decade switch.

For scaled variables, the value in the controller changes by +/- 1. However, the value displayed also depends on the scaling specified.

| **Key** | **Function** |
|---|---|
| 0 to 9 | 1. Standard and Mixmode - Enter the numbers 0 to 9<br>2. Increment - No function |
| Decimal point | Enters the decimal point. |
| Plus | 1. Standard - No function<br>2. Mixmode and Increment - Increments the value at the cursor and influences the more significant digits when the range of values is exceeded. |
| Minus | 1. Standard - No function<br>2. Mixmode and Increment - Decrements the value at the cursor and influences the more significant digits when the range of values is not reached. |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Delete | 1. Standard and Mixmode - Variable is selected: The value is deleted and you can enter a new value.<br>2. Standard and Mixmode - Cursor was moved within the value: The character is deleted and the more significant digits are moved to the left.<br>3. Increment - No function |

Fig. 5-7: Key functions for decimal numbers of the type BCD

Standard Mode

## 5.5.3.2 Alphanumeric

For alphanumeric display, ASCII strings are read in byte format from the controller, and displayed in the operating device. The number of characters displayed varies, depending on the options offered by the operating device. A variable of the type Alphanumeric cannot be longer than one display line. Longer texts are truncated.

The controller address specifies the start of the string. It does not contain a length byte, as this is not required.

You can use the plus and minus keys to input alphanumeric characters. The system variables Shift and ShiftCase are also available for upper case (Shift) and lower case (ShiftCase) respectively. You can use these keys to enter the additional characters displayed on the numeric keys.

To use the system variables, link the system variables as press and release variables with a function key to the mask. During input, the operator must press the function key and the corresponding numeric key.

You can use the Password field type to enable concealed password entry on the operating device. However, you can only enter numbers here. An “X” appears for each digit you enter.

See chapter “Password Protection“ on page 5-135.

| Key | Function | With Shift | With Shift-Case |
|---|---|---|---|
| 0 | Enters the number 0 | ()°0 | ()°0 |
| 1 | Enters the number 1 | STU1 | STUstu1 |
| 2 | Enters the number 2 | VWX2 | VWXvwx2 |
| 3 | Enters the number 3 | YZ%3 | YZ%yz%3 |
| 4 | Enters the number 4 | JKL4 | JKLjkl4 |
| 5 | Enters the number 5 | MNO5 | MNOmno5 |
| 6 | Enters the number 6 | PQR6 | PQRpqr6 |
| 7 | Enters the number 7 | ABC7 | ABCabc7 |
| 8 | Enters the number 8 | DEF8 | DEFdef8 |
| 9 | Enters the number 9 | GHI9 | GHIghi9 |
| Decimal point | Enters the decimal point. | :?!. | :?!:?!. |
| Plus | Enters the numbers 0 to 9, the letters A to Z and a to z | <=>+ | <=><=>+ |

Fig. 5-8: Key functions for alphanumeric variables

Standard Mode

| Key | Function | With Shift | With Shift-Case |
|---|---|---|---|
| Minus | Enters the numbers 0 to 9, the letters A to Z and a to z | */- | */*/- |
| Cursor Right | Moves the cursor one position to the right. | | |
| Cursor Left | Moves the cursor one position to the left. | | |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. | | |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. | | |
| Delete | Deletes the character at the cursor position. | | |

Fig. 5-8: Key functions for alphanumeric variables

### 5.5.3.3 Selection Text

You can choose to display a text instead of a numeric value. To do this, you must create a text list.

In the text list, you assign numeric values to the corresponding texts.

The operating device reads the value of the variable from the controller, replaces the numeric value with text, and displays this text. If a value is read from the controller, and you have not defined a corresponding text for this value, the system displays a number of question marks.

If the Selection Text type is used for an input variable, you can choose to limit the field height to one or several lines.

If you specify a field height of 1, the system always only displays one text from the text list. If the field height is greater than 1, a correspondingly higher number of texts from the text list is displayed. The active text is displayed inversely.

| Key | Function |
|---|---|
| 0-9 | No function |
| Decimal point | No function |
| Plus | Selection in ascending order (after the final value in the text list is reached, the value at top of the text list is selected next). |
| Minus | Selection in descending order (after the first value in the text list is reached, the value at the bottom of the text list is selected next). |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Delete | Deletes the character at the cursor position. |

Fig. 5-9: Key functions for selection texts

**Example:**

For the parity of an interface the text items „no parity“, „odd“ and „even“ should be displayed instead of „0“, „1“ and „3“. Therefore create a text list in the programming software with the following entries:

| Value | Text |
|---|---|
| 0 | no parity |
| 1 | odd |
| 2 | even |

Fig. 5-10: Example of a text list

In the „selection text“ dialog of the programming software select the name of the text list. Im Dialogfenster „Auswahltext“ von der Projektierungssoftware wählen Sie anschließend den Namen der Textliste aus. With this step you link the field for displaying the variable value with the text list.

### 5.5.3.4 Selection Image

You can choose to display images instead of numeric values, in the same way as you can use text to represent numeric values. In an image list, first of all assign individual images to the numeric values. The numeric values do not need to be contiguous or sorted consecutively. Then, in a mask create a variable field for the selection image variable. In the dialog field for the representation type Selection Image, link the variable with the image list. The corresponding image will then be displayed in the operating device, depending on the controller values used. The default image will be displayed for controller values that have not been specified in the image list.

Note that all of the images in an image list must be the same size, to ensure that they cover each other completely. Furthermore, make sure that the images used are not too large, to avoid slow display build-up. You may need to modify the polling time accordingly.

| **Key** | **Function** |
|---|---|
| 0-9 | No function |
| Decimal point | No function |
| Plus | Selection in ascending order (after the final value in the image list is reached, the value at top of the image list is selected next). |
| Minus | Selection in descending order (after the first value in the image list is reached, the value at the bottom of the image list is selected next). |
| Cursor Right | No function |
| Cursor Left | No function |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Delete | No function |

Fig. 5-11: Key functions for selection images

### 5.5.3.5 Floating Point Number

The significance of the displayed digits increases from right to left. The number can optionally be displayed with a decimal point. Scaling is only carried out using a factor. The operating device can also form the inverse value before display.

There are no blanks between the characters. In the controller, the variable appears in special floating point formats, for example, IEEE. Only some controllers support floating point numbers.

| Key | Function |
|---|---|
| 0 to 9 | Enters the numbers 0 to 9. |
| Decimal point | Enters the decimal point. |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Plus | 1st case: Variable is selected. The value is deleted and you can enter a new value.<br>2nd case: Cursor was moved within a positive value. The value is not changed.<br>3rd case: Cursor was moved within a negative value. The negative sign for the value is deleted. |
| Minus | 1st case: Variable is selected. The value is deleted, and a negative sign is inserted at the least-significant position. You can enter a new value.<br>2nd case: Cursor was moved within a positive value. A negative sign is placed in front of the value.<br>3rd case: Cursor was moved within a negative value. The value is not changed. |
| Delete | Deletes the position where the cursor is located, and also deletes the sign. |

Fig. 5-12: Key functions for floating point numbers

### 5.5.3.6 Hexadecimal Number

The significance of the displayed digits increases from right to left. Hexadecimal numbers are displayed with the digits 0 to 9 and A to F in upper case, and with leading zeros.

The representation refers to the data types byte, word, and LWord. The maximum length is 8 digits. There are no blanks between the characters.

Standard Mode

**Example:** A hexadecimal number:

| $16^4$ | $16^3$ | $16^2$ | $16^1$ | $16^0$ | Significance |
|---|---|---|---|---|---|
| 0 | E | 4 | 5 | A | Displayed = 0E45AH |

| Key | Function |
|---|---|
| 0 to 9 | Enters the numbers 0 to 9. |
| Decimal point | No function |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Plus | Enters the characters 0 to 9 and A to F in ascending order. |
| Minus | Enters the characters 0 to 9 and A to F in descending order. |
| Delete | No function |

Fig. 5-13: Key functions for hexadecimal numbers

## 5.5.3.7 Binary Number

You use binary numbers to display individual bits, bytes, words, and Lwords. Select the number of bits and blank spaces for display. Both values are used to determine the entire field length.

There are a maximum of 32 bits for each variable. There can be no more than 255 blank spaces between the bits.

The significance of the displayed digits can be displayed in ascending order from either left to right or from right to left.

Example for displaying a binary number with or without blank spaces:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | | | | | Blanks = 0 |
| 0 | | 1 | | 0 | | 0 | | Blanks = 1 |
| 0 | | | 1 | | | 0 | 0 | Blanks = 2 |

| Key | Function |
|---|---|
| 0 and 1 | Enters the numbers 0 and 1. |
| 2 to 9 | No function |
| Decimal point | No function |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Plus | Enters the characters 0 and 1. |
| Minus | Enters the characters 0 and 1. |
| Delete | No function |

Fig. 5-14: Key functions for binary numbers

### 5.5.3.8 Bars

You can use the representation type Bars only to output variable values.

The variable values are refreshed either cyclically or one time, when the mask is opened.

You use the height and width values to determine whether the bars run horizontally or vertically. From a particular reference point, the dimension of a bar can be:

– in a positive direction
– in a negative direction
– in both directions

Specify the width and height in the unit 'Character'. The entire bar can only ever accept the size of a multiple of a character. When the controller values are output, however, the bar changes its dimension by pixel size.

You use two values to define the range of values that a bar will display.

Use the first value to definethe value of the bar on the left or bottom end.

Use the second value to define the value of the bar on the right or top end.

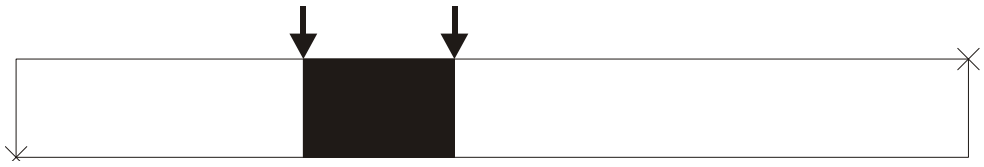

Fig. 5-15: Horizontal bars

Standard Mode

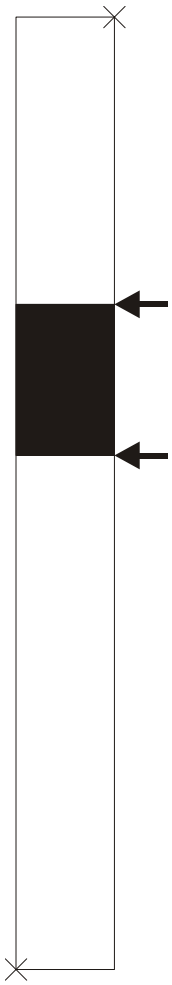

Fig. 5-16: Vertical bars

The range of values is limited to values from -32768 to +32767.

To display several bars in a mask, ensure that the controller addresses are consecutive and contiguous. This will speed up data transfer.

You can use four fill patterns for bars:

1. For the empty area of the bar (background).
2. For the filled area of the bar (foreground).
3. For the bar, if the lower value is not reached.
4. For the bar, if the higher value is exceeded.

The programming software contains four standard fill patterns. You can use any other images as fill patterns. Prior to use, you must import these images into the programming software or insert them as OLE.

See chapter “Images“ on page 5-108.

Standard Mode

**Example of fill status display:** Four graphics have been created for the example. They display a container that is either empty or full. The word MIN is used to demonstrate a situation in which the value is not reached. And the word MAX to depict a situation in which the value is exceeded. The container in the middle depicts a container for a case where the operating device displays a mid-point controller value for the variables.

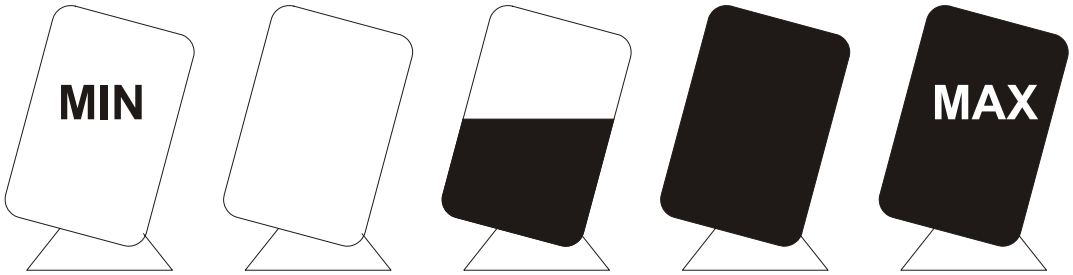


Fig. 5-17: Example of fill status display

## 5.5.3.9 Curve

Use the representation type Curve to display a value table as a row of points in the operating device.

The address for the controller variable represents the start of the value table in the controller. Each value in the table describes one pixel of the curve.

A curve is defined by the following parameters:

– Maximum width (54 pixels for each curve variable)
– Maximum height (height of the display in the operating device)

Specify a length and height to determine the dimension of the curve in the unit 'Character'.

To produce a curve with a width of 54 pixels, several curve variables next to each other are required.

Insert a coordinate grid as a background image.

The operating device reads the variable values as an array from the controller, and inserts these as continuous consecutive height data. The value with the starting address (address +0) is displayed on the very left. Each subsequent piece of height data (address +n) is offset one pixel position to the right.

The height data for the curve is cyclically refreshed.

Standard Mode

**Example of a curve display:**

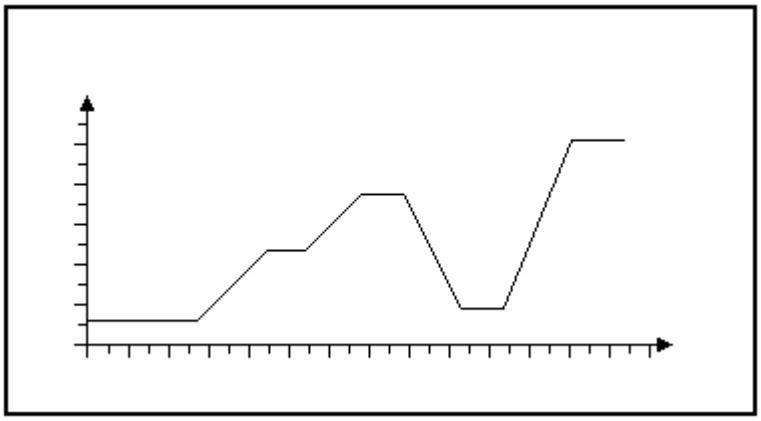

Fig. 5-18: Example for displaying a curve

## 5.5.3.10 Fields

You can add fields to masks, to carry out specific tasks. Depending on the type of field added, the mask can be a message mask, recipe mask, or table mask. At runtime, you can display the messages sent by the PLC in the message field of a message mask. For a recipe mask, you must set up a recipe field to display the contents of a recipe. In the table field of a mask, data is displayed in tabular form.

### Message Field

The message field refers to the area in a mask that is used to display messages.

To create a message field, carry out the following steps:

1. Select the **Message Field** icon in the toolbar and in the mask select the area where messages will be displayed.

This area is displayed as a rectangle. The message field is marked with the letter M on the left edge of the rectangle.

2. You can use the sizing handles to change the height of the area. You cannot change the width of the area.
3. In the Message System area, determine whether messages of the parallel message system or the serial message system will be displayed in the current message field.

You can determine the height of the message field in the Height of Message Field area. A message field can have a maximum height of 60 lines.

In the Representation of Message area, you can specify data that can be changed when the operating device is running.

**Global settings:** If this parameter is active, default settings from the system parameters are used for the message system.

**Message group:** The system outputs the group identifier before the message text.

**Message number:** The system outputs the message number before the message text.

**Message date:** The system outputs today's date before the message text. In the date, the year can either be output as two digits or four digits. The value of the date is frozen with the message.

**Time of message:** The system outputs the time before the message text. The value of the date is frozen with the message.

The maximum number of lines per message specifies that only the number of lines entered here will be displayed. The standard value is the maximum value of 255 lines.

In the Time Period area, you can specify the time period from which messages will be displayed.

**Chronicle:** The system displays all messages.

**Old list:** The system only displays acknowledged messages that do not have the status Disappeared.

In the Group Assignment area, you can select whether you would like to display message groups in the current message field, and if you would, specify the corresponding groups. Next to the group number, the system also displays the group identifier that you set up. Select the check box next to the group number, to select the required group. Any number of combinations are possible. If you do not select any check box, the system can display all groups.

The Font area specifies the character set used to display all elements of a message field on the operating device. To display all elements of a message field in another font, click the **New** button.

## Recipe Field

The Recipe field classifies the area in a mask used to display recipes.

Select the **Recipe Field** icon in the toolbar and in the mask select the area where recipes will be displayed. This area is displayed as a rectangle. The recipe field is marked with the letter R on the left edge of the rectangle. You can use the sizing handles to change the height of the area. You cannot change the width of the area.

Select the name of the recipe for which you want to set up a recipe field.

Just below, enter the height for the recipe field in the mask

The Font area specifies the character set used to display all elements of a recipe field on the operating device. To display all elements of a recipe field in another font, click the New Font button.

### Table Field

The Table field classifies the area in a mask used to display values in a table.

Select the **Table Field** icon in the toolbar and in the mask select the area where the table will be displayed. This area is displayed as a rectangle. The table field is marked with the letter T on the left edge of the rectangle. You can use the sizing handles to change the height of the area. You cannot change the width of the area.

Specify here, how many lines the table field will have and how many elements can be displayed in this table field.

The Font area specifies the character set used to display all elements of the table on the operating device. To display all elements of a table in another font, click the **New** button.

To display variable values in the table, create a variable frame in the table field. Specify the address for the variable and select the representation type.

Variables displayed in a button that has a frame cannot be dragged with the mouse to the table field. Frames of buttons cannot be displayed in tables.

**Example:**

You have 256 elements you want to be displayed in a table which has four columns. The operating device has screen with 20 lines.16 of these lines are to be used to display elements. Therefore, create a table field with a height of 16. Enter 64 (16 lines x 4 elements) for the number of table elements.

## 5.5.4 Field Type

By selecting a field type, you determine whether the operator will be able to modify the variable's value or whether the value is just displayed.

For password entry, you can specify the field type in more detail.

### 5.5.4.1 Input

Select the field type Input to enable operators to change the value of a variable on the operating device.

The value of the variables is loaded from the controller when the mask is accessed.

If you select the attribute Cyclical, the system constantly updates the value of the variables, based on the interval specified in the polling time.

Before input, the operator must press the Data Release key. The operator can only change the value of the variables once the status LED for the data release is lit. Use the Enter key to write the value to the controller. The operator must then press the Data Release key. The status LED for the data release switches off.

### 5.5.4.2 Output

Select the field type Output to only display the value of the variables, but not allow the operator to change the value.

The value of the variables is loaded from the controller when the mask is accessed.

If you select the attribute Cyclical, the system constantly updates the value of the variables, based on the interval specified in the polling time.

### 5.5.4.3 Password

You can use the additional attribute Password to determine for an alphanumeric variable that the password is not visible on the operating device when it is entered.

Instead of displaying the values entered, the system displays the operator a string of “X“ when the password is entered.

### 5.5.4.4 Cyclical

The operating device always polls the controller for the value of a variable when the operator goes to a mask in which a value is to be displayed. However, to display actual values, the value must be continuously updated. Therefore, always select the field type Cyclical for displaying actual values.

The system will then continuously update the value of the variables, based on the interval set as the polling time.

Standard Mode

## 5.5.5 Format

### 5.5.5.1 Only Positive

Use the attribute Only Positive to display variable values that are to be displayed without a sign. This means that the range of values that can be displayed changes, for example, for a byte, from between -128 and +127 to between 0 and 255.

You can also display positive decimal numbers with leading zeros.

### 5.5.5.2 Display Leading Zeros

For positive decimal numbers, you can display more significant digits with a value of zero as zeros.

**For example:** If the field length is 5 digits, the number 25 is displayed with leading zeros as follows:

00025

### 5.5.5.3 Field Length

The field length of a variable is made up of:

- The sign
- The number of digits
- The decimal point

For the representation type Binary Number, the number of blank spaces is added to the number of digits, to determine the field length.

### 5.5.5.4 Fractional Digits

You can define the number of fractional digits for decimal and floating point numbers.

This does not change the field length, however, one digit for displaying the decimal point is lost.

## 5.5.6 Documentation Value

The documentation value for displaying a variable is a placeholder when you program. Depending on the representation type you are using, The programming software specifies another documentation value, for example, 'F' for hexadecimal numbers or '9' for decimal numbers.

The documentation value is also used for project documentation instead of a real controller value.

See chapter “Documentation“ on page 5-192.

## 5.5.7 Limits

In the programming software, you can specify a lower and an upper limit for each variable to restrict operator input.

The lower limit is automatically set to 0 for variable values that are displayed with the attribute Only Positive.

If the operator tries to enter a value outside of these limits, one of the following system messages is issued:

– Value too small
– Value too large

The operator can ignore these system messages, but he must enter a value that lies between the limits, or use the Cursor Up or Cursor Down keys to go to another variable in the mask. The system then accepts the current controller value again.

Standard Mode

## 5.5.8 Scaling

### 5.5.8.1 Scaled Input

To modify the values that the operator enters in the operating device in line with the values used in the connected controller, inverse scaling must be carried out.

The system uses the following formula to scale the input:

$$\text{Controller Value} = \frac{\text{Input Value of the Unit} - \text{Summand}}{\text{Factor}} \times \text{Divisor}$$

Fig. 5-19: Scaling of the input variables in the operating device

A rounding error may occur during scaling which is calculated using the following formula.

$$\left( \boxed{\text{Input Value of the Unit}} \times \text{Factor} \right) < \left( \text{Upper Limit} - \text{Divisor} / 2 \right)$$

Fig. 5-20: Rounding of the input variables in the operating device

### 5.5.8.2 Scaled Output

You can scale output to modify the range of values to suit user interface requirements. The scaling data is used for both output and input in the operating device. This does not restrict the range of values for the variable. Scaling is only carried out in the operating device.

You use the following operands for scaling:

- Factor,
- Divisor and
- Addend.

Note that a factor or divisor with the value 0 is not permitted.

| **Operand** | **Range of Values** |
|---|---|
| Factor | –32768 to –1, +1 to +32767 |
| Divisor | +1 to +32767 |
| Addend | –32768 to +32767 |

Fig. 5-21: Scaling decimal numbers

| **Operand** | **Range of Values** |
|---|---|
| Factor | –999999999,99999999 to –0,00000001+0,00000001 to +999999999,99999999 |
| Divisor | –999999999,99999999 to –0,00000001+0,00000001 to +999999999,99999999 |
| Addend | –999999999,99999999 to +999999999,99999999 |

Fig. 5-22: Scaling floating point numbers

The operating device uses the following formula to scale the output:

$$\textbf{Output Value of the Unit} = \frac{\textbf{Controller Value} \times \text{Factor}}{\text{Divisor}} + \text{Summand}$$

Fig. 5-23: Scaling of the output variables in the operating device

Use the following formula to determine the operands.

$$\frac{\text{Current Controller Value} - \text{Lower Limit Controller Values}}{\text{Current Terminal Value} - \text{Lower Limit Output Values}} = \frac{\text{Upper Limit Controller Values} - \text{Lower Limit Controller Values}}{\text{Upper Limit Output Values} - \text{Lower Limit Output Values}}$$

Fig. 5-24: Scaling of the output variables

The following example will help you determine the operands.

**Example:**

Range of values for output values:
Lower limit for output value = 0
Upper limit for output value = 100
Current value in operating device = x

Range of values for controller values:
Lower limit for controller values = -4096
Upper limit for controller values = 4096
Current controller value = y

1. Inserting the variable values:

$$\frac{y - (-4096)}{x - 0} = \frac{4096 - (-4096)}{100 - 0}$$

$$\frac{y + 4096}{x} = \frac{4096 + 4096}{100}$$

Fig. 5-25: Inserting the variable values in the formula

2. Solving the equation:

$$100\,y + 409600 = 8192\,x$$

Fig. 5-26: Solving the equation

3. Solving the equation for x:

$$x = \frac{100}{8192}\,y + \frac{409600}{8192}$$

$$x = \frac{\boxed{100}}{\boxed{8192}}\,y + \boxed{50}$$

Factor
Summand
Divisor

Fig. 5-27: Solving the equation for x

## 5.5.9 Communication Definition

### 5.5.9.1 PLC Handshake

Select the attribute PLC Handshake to inform the controller that the values of the **subsequent controller variables of the current mask** are to be changed.

To do this, you must:

– Create a variable for the Read Coordination byte AND
– Create a variable for the polling area

See chapter “Read Coordination Byte“ on page 5-119.
See chapter “Write Coordination Byte“ on page 5-121.

The attribute PLC Handshake allows you to:

– Create your own recipe management system
– Inform the controller that a specific variable value will be changed

Standard Mode

The PLC handshake process runs as follows:

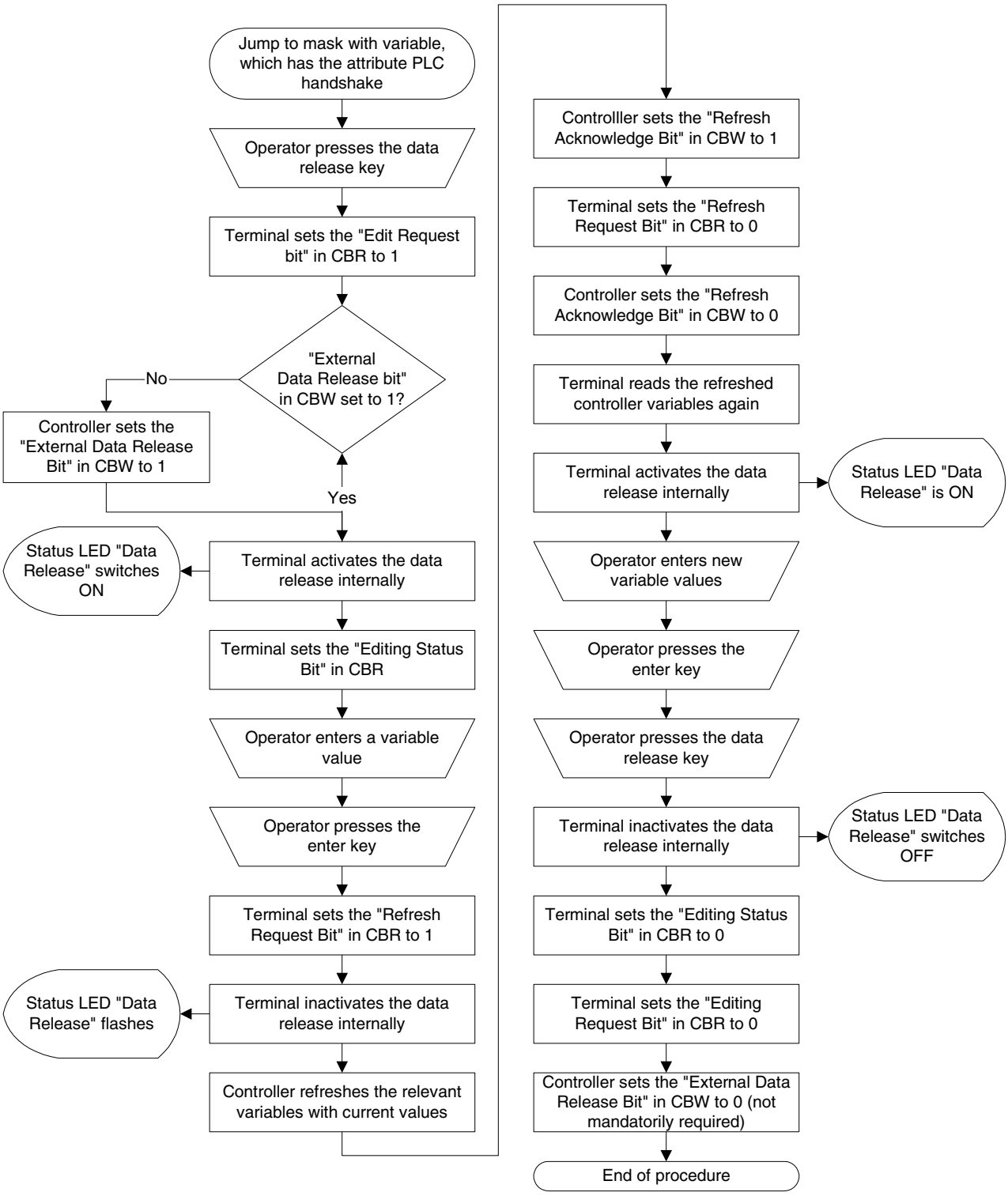
Jump to mask with variable, which has the attribute PLC handshake
Operator presses the data release key
Terminal sets the "Edit Request bit" in CBR to 1
"External Data Release bit" in CBW set to 1?
No
Yes
Controller sets the "External Data Release Bit" in CBW to 1
Status LED "Data Release" switches ON
Terminal activates the data release internally
Terminal sets the "Editing Status Bit" in CBR
Operator enters a variable value
Operator presses the enter key
Terminal sets the "Refresh Request Bit" in CBR to 1
Status LED "Data Release" flashes
Terminal inactivates the data release internally
Controller refreshes the relevant variables with current values
Controlller sets the "Refresh Acknowledge Bit" in CBW to 1
Terminal sets the "Refresh Request Bit" in CBR to 0
Controller sets the "Refresh Acknowledge Bit" in CBW to 0
Terminal reads the refreshed controller variables again
Terminal activates the data release internally
Status LED "Data Release" is ON
Operator enters new variable values
Operator presses the enter key
Operator presses the data release key
Terminal inactivates the data release internally
Status LED "Data Release" switches OFF
Terminal sets the "Editing Status Bit" in CBR to 0
Terminal sets the "Editing Request Bit" in CBR to 0
Controller sets the "External Data Release Bit" in CBW to 0 (not mandatorily required)
End of procedure

Fig. 5-28: Flow diagram for PLC handshake

### 5.5.9.2 With Enter

The operator must press the Enter key to transfer the value of the variables from the operating device to the controller.

### 5.5.9.3 With +, –, or Enter

Each time the operator presses the Plus and Minus keys, he transfers the incremented or decremented value to the controller. If the operator uses the 0 to 9 keys to enter the value, he must then press the Enter key.

### 5.5.9.4 For all changes

The operator can change the value of a variable only with the Plus and Minus keys. The changed value is transferred to the controller each time you select the Plus and Minus keys.

## 5.5.10 Access Type

### 5.5.10.1 Normal

Use the access type Regular for accessing selection text, or selection image variables for projects that do not use any variant options. The system then displays for selection all entries in a text list or an image list.

### 5.5.10.2 Selective

Use the access type Selective to only display the selection texts or selection images that are “released“ using a controller variable. Each bit of the controller variable represents an entry in the text or image list.

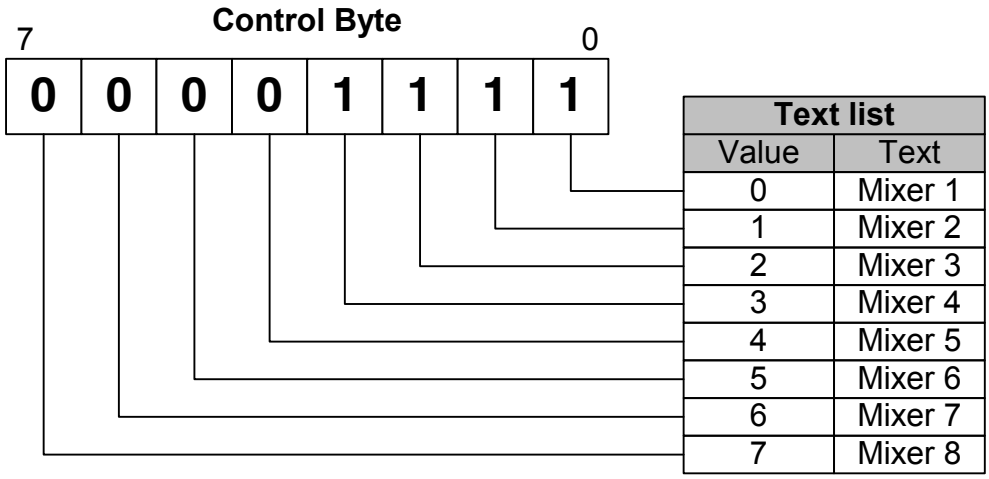


Fig. 5-29: Selective access

You can use the control byte depicted in the Selective Access image to only display the first four entries in the text list.

The controller variable is only read once, when the operating device is being initialized!

Enter the name of the controller variable in the Variant Buffer field of the Variant Option dialog box.

### 5.5.10.3 Article Administration

To administrate the article data by means of the small operator terminal the article number and article name of each article is loaded from the controller to the small operator terminal.

The operator can select an article by an apropriate selection field. Therefore the stored article names are served as selection text items and the article numbers are the values transferred to the controller, when the data release key is pressed.

#### Generating the Article List

After a cold- or warm boot the article list in the small operator terminal is empty. This means that, i.e. after a communication error the whole article list must be transferred to the small operator terminal.

Enlarging the article list by one item is performed by means of the DIN-Measurement bus service **New Entry to Article List**. The new item consists of an article name and an article number as parameter. The length of the article name ist limited by the width of the small operator terminal display. The size of the article number is two byte.

The new entry is added to the end of the article list. The order of the entries in the article list influences the order of the text items displayed

in the selection text field of the mask.

The maximum amount of entries in the article list is 255 items.

## Marking an Artikel as Active

By means of the DIN-Measurement bus service **Report Current Article** you can mark an article of the list as active. The service contains the article number as parameter.

The article marked as active is not displayed in a selection text field used to delete article data from the controller.

After a cold or warm boot or after deleting the active entry in the article list no article is marked as active.

## Access on the Article List

The article list serves as data base for selection fields in which you select the articles stored in the controller.

To parameterize the selection field in the programming software you must select „spec. selection“ as type of selection. A dialog for entering the customer identity appears. Please enter the code **Bosch** in this dialog.

Next an additional dialog appears where you can select whether a selection text field is set-up with a complete article list (general article selection) or an article list without the active marked article (article selection when deleting).

Entering the values and text items for the selection text field is not necessary, because these data is delivered by the artice list.

Selecting an article at the small operator terminal is performed by the "+" and "-" keys and is acknowledged by the enter key. The corresponding article number is then transferred to the controller.

If a data set must be copied to another address before you can continue working, the access can be temporarily denied by means of the PLC handshake bit.

## Article Administration (delete)

Deleting an entry in the article list is performed by means of the DIN-Measurement bus service **Delete entry in article list**. The service contains the article number as parameter.

Deleting the whole content in the article list is performed by means of the DIN-Measurement bus service **Delete all entries in article list**.

## 5.5.11 Variable Type

### 5.5.11.1 Standard

The standard type is the variable type most frequently used to display decimal numbers. The maximum length depends on the data type. The significance of the displayed digits increases from right to left. There are no blanks between the digits.

| Significance | $10^3$ | $10^2$ | $10^1$ | $10^0$ | $10^{-1}$ | $10^{-2}$ |
|---|---|---|---|---|---|---|
| Displayed 123,45D | 0 | 1 | 2 | 3 | 4 | 5 |

### 5.5.11.2 BCD Number

A BCD number must be saved in the controller in BCD format. The operating device can interpret and display up to eight digits. The significance of the displayed digits increases from right to left. There are no blanks between the digits. The value can be displayed with leading zeros.

| Significance | $10^4$ | $10^3$ | $10^2$ | $10^1$ | $10^0$ |
|---|---|---|---|---|---|
| Displayed 1234D | 0 | 1 | 2 | 3 | 4 |

## 5.5.12 Attributes (Static or Dynamic)

### 5.5.12.1 Global

Variables with the attribute Global:

- Appear in all languages for a project
- Appear in all masks with the same name
- Appear in the same position

If you change the parameters of these variables, the changes apply to all masks with the same name and to all languages for the project.

### 5.5.12.2 Inverse

Variables with the attribute **Inverse** are displayed so that the foreground and background colors are swapped.

### 5.5.12.3 Flashing

Variables with the attribute **Flashing** are displayed so that the fore-

ground and background colors change at specific intervals. The attribute Flashing cannot be displayed in the programming software. The result only appears in the operating device.

### 5.5.12.4 Underline

Variables with the attribute **Underline** are displayed with a line under the entire variable value.

### 5.5.12.5 Invisible

The attribute **Invisible** is only evaluated together with a control variable. In all other cases, the attribute **Invisible** results in an error message during compilation, and no S3 file is generated.

Static texts and one-off variables (variables that are output only once) with the attribute **Invisible** are not output.

Cyclical variables with the attribute **Invisible** are overwritten with blanks. This erases any existing obsolete value on the screen.

If background images and cyclical variables are being used simultaneously, the background image is not updated!

Regarding input variables, note that the operator cannot enter the range of values for the attribute **Invisible**. If an input value is in the area of the attribute **Invisible**, the edit process is not started. The operator then has no possibility to change the value again.

### 5.5.12.6 Non-Editable

The **Non-editable** attribute selectively prevents variable values from being changed. The system then only outputs the variable value one-off or cyclically.

You can only use the **Non-Editable** attribute in conjunction with a control variable.

## 5.5.13 Font

The Font attribute determines the font in which the characters are displayed in a mask.

Note:

- Only some operating devices can display fonts up to any size.
- The names of the fonts cannot be changed.
- You can select a separate font for each static text in a mask.
- The system displays all messages using the same font.
- The system displays all elements in a recipe using the same font.

## 5.5.14 Help Mask

To optimize usability, you can create a help mask for all masks and all variables. To call this help mask in the operating device, press the **Help** key or a corresponding button.

On operating devices equipped with a keyboard, the help mask is only displayed for as long as you keep the **Help** key pressed.

A help mask is the same size as a standard mask. You can insert static text, background images, output variables, and tables in a help mask. You can also link help masks to sub-masks, to ensure that help masks have a uniform appearance.

If a mask or variable is not linked with a help mask, only the default help mask is displayed. You can also design the default help mask to suit your own needs.

The help text for a mask is displayed until data release is requested. Otherwise the help is displayed for the variable that is currently being edited.

## 5.5.15 Output Variables

Output variables are numeric or alphanumeric memory content from the connected controller. The variable values are requested from the controller if required, and displayed at the program location using the corresponding representation type.

### 5.5.15.1 One-Off and Cyclical Output Variables

Pure output variables are transferred once from the controller when the mask is being called-up, and are displayed in the mask. Outputting the variable only once helps improve communication performance, and can be used for all variables, such as setpoint values, constants, and parameters that rarely or never change. All output variables can be dis-

played as scaled or formatted.

Cyclical output variables are used to display actual values and values that continuously change while a mask is being output.

You specify the cycle time with the polling time. This means that you know at this stage how often the display of the actual values will be refreshed.

To improve the performance of transfer to the controller, use data types identically and ensure that the address ranges of a mask are as continuous as possible.

The scaling and formatting of cyclical output variables, in particular of decimal numbers as floating point numbers, requires a corresponding computing time, and as a result the data is not output in real time.

For these applications, select cycle times > 500 ms.

The more cyclical data is transferred, the longer the reaction time to new values from the controller.

### 5.5.15.2 Formatted Output

You can format a numeric variable value to suit an output area.

Formatting consists of:

- Field Length
- Fractional Digits
- Positive Values Only
- Display Leading Zeros

The field length determines the entire length of the output value, including signs, decimal points, and fractional digits.

The number of fractional digits gives the operator the impression that a value has been divided, however, in reality no value has been divided. However, the variable value must exist in the controller in a correspondingly high resolution.

**Example:**

In the controller, the value of a length is stored as a word.The range of values is between 0 and 65535. The following settings are made for display:

- Decimal number
- Output
- Only positive
- Field length = 6 (5 + decimal point)
- Fractional digits = 2 (absolute)

The display area is between 0,00 and 655,35. If the check box Only Positive is not selected, the display area changes. The value is displayed with a sign. You must specify an additional position in the field length for the sign. The following data is required:

– Decimal number
– Output
– Field length = 7 (5 + decimal point + sign)
– Fractional digits = 2 (absolute)

The display range is then between –327.68 and +327.67.

## 5.5.16 Input Variables

When displaying input variables for the first time in the operating device, the system uses the same approach as for one-off output variables (output variables that are output only once). This also applies to scaling, which works from the controller's viewpoint.

Input variables are processed by editors in the operating device.

### 5.5.16.1 Plausibility Check

The system carries out a plausibility check for all input variables. During this check, it compares the value entered with the range limits stored in the variable list.

If the limits are not adhered to, the system issues one of the following system messages:

– 'Value too large' or
– 'Value too small'

The incorrect value is not written to the controller. If an error occurs, the previously valid value is retained.

To prevent the above-mentioned system messages from appearing, you must delete them in the programming software. When you do this, the following applies:

– If the value is exceeded, the value of the upper limit is entered
– If the value is not reached, the value of the lower limit is entered

Standard Mode

## 5.5.17 System Variables

You can use system variables to control the operating device's internal functions.

You can display and change the value of system variables either in a mask or using any suitable representation type, function or soft key.

When you link a system variable with a function key or soft key, the following rules apply:

– Do not use the same key to link a mask change and a system variable.
– You do not have to link Set (1) and Reset (0) with the same key, except if you are setting up a jogging mode.

Do not add the names of system variables to the variable list! In the same way as you use the name of a system variable for a controller variable, the function is lost for the operating device.

### 5.5.17.1 Basic Functions

#### IntEraseEprom

| | | |
|---|---|---|
| Function | | Deletes the project from the Flash memory and places the operating device into the download mode. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Deletes the project |

#### MainVersion

| | | |
|---|---|---|
| Function | | Displays the current firmware version. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric, field length = 8 |
| Configurable values | | Format determined by the manufacturer. |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

Standard Mode

## ComVersion

| | | |
|---|---|---|
| Function | | Displays the type and version number of the current protocol. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric, field length = 8 |
| Configurable values | | Format determined by the manufacturer. |

## UserVersion

| | | |
|---|---|---|
| Function | | Displays the project's version number. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | 0 to 255 |

## Boot

| | | |
|---|---|---|
| Function | | Boots the operating device (system restart). |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Boot |

## LcdContrast

| | | |
|---|---|---|
| Function | | Sets the contrast of LC displays. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | Depends on the operating device type. |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

Adhere to the values for the upper and lower limits, as specified in the user manual for the relevant operating device.

## LcdBackground

| | | |
|---|---|---|
| Function | | Displays masks in inverted format on operating devices equipped with a LC display. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Not inverted |
| | 1 | Inverted |

## LcdBackLight

| | | |
|---|---|---|
| Function | | Brightness of the backlighting of LC displays. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | Depends on the operating device type. |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

Adhere to the values for the upper and lower limits, as specified in the user manual for the relevant operating device.

## TurnOnTemp

| | | |
|---|---|---|
| Function | | Temperature value at which the display is automatically switched on. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Display OFF |
| | 1 | Display ON |

Standard Mode

## OsLanguage

| | | |
|---|---|---|
| Function | | For multilingual projects, this variable is used for online language selection. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | First language |
| | N | n–th language |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

## IdentName

| | | |
|---|---|---|
| Function | | Displays the name of the current project (application ID). |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 13 characters |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

## IdentVersion

| | | |
|---|---|---|
| Function | | Displays the version of the current project (application ID). |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 5 characters |

Standard Mode

## IdentDate

| | | |
|---|---|---|
| Function | | Displays the date of the current project (application ID). |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 6 characters |

## IdentTime

| | | |
|---|---|---|
| Function | | Displays the time of the current project (application ID). |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 6 characters |

## IdentCount

| | | |
|---|---|---|
| Function | | Displays the counter value of the current project (application ID). |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 4 characters |

## IdentRandom

| | | |
|---|---|---|
| Function | | Displays the current project's ending (application ID). |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 2 characters |

### ComErrorRetry

| | | |
|---|---|---|
| Function | | Displays the number of communication errors. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to n | Number of communication errors |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

## 5.5.17.2 Communication SER1

### ComDataLenA

| | | |
|---|---|---|
| Function | | Sets the number of data bits for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | 5 Bit |
| | 1 | 6 Bit |
| | 2 | 7 Bit |
| | 3 | 8 Bit |

### ComParityA

| | | |
|---|---|---|
| Function | | Sets the parity for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No parity |
| | 1 | Odd parity |
| | 2 | Even parity |

Standard Mode

## ComStopBitsA

| | | |
|---|---|---|
| Function | | Sets the number of stop bits for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | 1 Bit |
| | 1 | 1,5 Bit |
| | 2 | 2 Bit |

## ComBaudrateA

| | | |
|---|---|---|
| Function | | Sets the baud rate for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | 300 Baud |
| | 1 | 600 Baud |
| | 2 | 1200 Baud |
| | 3 | 2400 Baud |
| | 4 | 4800 Baud |
| | 5 | 9600 Baud |
| | 6 | 19200 Baud |
| | 7 | 38400 Baud |
| | 8 | 57600 Baud (operating devices with 386 CPU only) |

## ComHandshakeA

| | | |
|---|---|---|
| Function | | Sets the handshake method for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No handshake |
| | 1 | Hardware handshake (RTS/CTS) |
| | 2 | Software handshake (XON/XOFF) |

Standard Mode

## ComDefaultA

| | | |
|---|---|---|
| Function | | Activates the interface parameters for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Activates the interface parameters entered by the operator. |
| | 2 | Activates the interface parameters that were specified in the programming software. |

## ComTimeout

| | | |
|---|---|---|
| Function | | Sets the timeout watchdog time for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No timeout watchdog (Initial state) |
| | 1 to 65535 | Timeout watchdog time in ms |

## ComRetryTimeout

| | | |
|---|---|---|
| Function | | Sets the waiting time (delay) after which another connection setup is attempted for SER1. This time period allows to span the time period required for the PLC-specific power-up phase, thereby preventing error messages from being generated. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 65535 | Waiting time in ms |

Standard Mode

## ComSlaveNr

| | | |
|---|---|---|
| Function | | Sets the slave number for an operating device connected to a network. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | Slave number |

## ComErrorCode

| | | |
|---|---|---|
| Function | | Displays the last error code issued for a COMMUNICATION, SYSTEM, or FATAL error. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 99999 | |

By inserting this system variable into the message text of a message, the error code will be stored in the message memory in addition to the message.
See chapter “Serial Message System“ on page 5-171.

## ComErrorSubcode

| | | |
|---|---|---|
| Function | | Displays the last error subcode (low word) issued for a COMMUNICATION, SYSTEM, or FATAL error. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 99999 | |

By inserting this system variable into the message text of a message, the error code will be stored in the message memory in addition to the message.
See chapter “Serial Message System“ on page 5-171.

## 5.5.17.3 Error Statistics SER1

### ComParityCount

| | | |
|---|---|---|
| Function | | Displays the number of parity errors for SER1. Is deleted at every download. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 65535 | Number of parity errors |

### ComOverrunCount

| | | |
|---|---|---|
| Function | | Displays the number of overrun errors. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 65535 | Number of overrun errors |

### ComFrameCount

| | | |
|---|---|---|
| Function | | Displays the number of framing errors. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 65535 | Number of framing errors |

## 5.5.17.4 Communication SER2

### ComDataLenB

| | | |
|---|---|---|
| Function | | Sets the number of data bits for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |

Standard Mode

| | | |
|---|---|---|
| Configurable values | 0 | 5 Bit |
| | 1 | 6 Bit |
| | 2 | 7 Bit |
| | 3 | 8 Bit |

## ComParityB

| | | |
|---|---|---|
| Function | | Sets the parity for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No parity |
| | 1 | Odd parity |
| | 2 | Even parity |

## ComStopBitsB

| | | |
|---|---|---|
| Function | | Sets the number of stop bits for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | 1 Bit |
| | 1 | 1,5 Bit |
| | 2 | 2 Bit |

Standard Mode

## ComBaudrateB

| | | |
|---|---|---|
| Function | | Sets the baud rate for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | 300 Baud |
| | 1 | 600 Baud |
| | 2 | 1200 Baud |
| | 3 | 2400 Baud |
| | 4 | 4800 Baud |
| | 5 | 9600 Baud |
| | 6 | 19200 Baud |
| | 7 | 38400 Baud |
| | 8 | 57600 Baud (operating devices with 386 CPU only) |

## ComHandshakeB

| | | |
|---|---|---|
| Function | | Sets the handshake for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No handshake |
| | 1 | Hardware handshake (RTS/CTS) |
| | 2 | Software handshake (XON/XOFF) |

## ComDefaultB

| | | |
|---|---|---|
| Function | | Activates the interface parameters for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Activates the interface parameters entered by the operator. |
| | 2 | Activates the interface parameters that were specified in the programming software. |

Standard Mode

## 5.5.17.5 Real-Time Clock

The values for the real-time clock can be set from the operating device and from the controller.
See chapter “Date and Time Image“ on page 5-139.

### RTCSec

| | | |
|---|---|---|
| Function | | Sets the seconds of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number, bar |
| Configurable values | 0 to 59 | Seconds |

### RTCMin

| | | |
|---|---|---|
| Function | | Sets the minutes of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number, bar |
| Configurable values | 0 to 59 | Minutes |

### RTCHour

| | | |
|---|---|---|
| Function | | Sets the hours of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number, bar |
| Configurable values | 0 to 23 | Hours |

Standard Mode

## RTCDay

| | | |
|---|---|---|
| Function | | Sets the day of the date for the real-time clock. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 31 | Number of days depends on the month. Invalid settings are corrected by the real-time clock next time when the date changes. |

## RTCMonth

| | | |
|---|---|---|
| Function | | Sets the month of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 to 12 | |

## RTCYear

| | | |
|---|---|---|
| Function | | Sets the year of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 99 | Only the year and decade are influenced. |

## RTCDayOfWeek

| | | |
|---|---|---|
| Function | | Sets the day of the week of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 6 | Only for operating devices with TMP Z84 CPU or RISC–CPU |
| | 1 to 7 | Only for operating devices with 386 CPU |

Standard Mode

### RTCDateFmt

| | | |
|---|---|---|
| Function | | Sets the date format for the message output. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Europe DD MM YY |
| | 1 | USA MM DD YY |
| | 2 | Japan YY MM DD |

### RTCYear2000

| | | |
|---|---|---|
| Function | | Sets a 4-digit year of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 9999 | |

## 5.5.17.6 Serial Message System

### RepmanSortCrit

| | | |
|---|---|---|
| Function | | Defines the sorting criteria for message output. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | By priority of message number |
| | 1 | In order of arrival (most recent first) |
| | 2 | In order of arrival (oldest first) |
| | 3 | By group |

## ClearRepBuf

| | | |
|---|---|---|
| Function | | Erases the memory for the serial messages. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Delete all messages from the message memory |
| | 2 | Delete only the acknowledged messages from the message memory |

## RepmanRepPrint

| | | |
|---|---|---|
| Function | | Is used to have messages output to a printer. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Formatted output, the interface is used permanently. |
| | 2 | Complete output, the interface is used permanently. |
| | 3 | Formatted output, the interface is used temporarily. |
| | 4 | Complete output, the interface is used temporarily. |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

If you use the interface permanently for message output, it will not be possible to send any other print jobs to the printer.

If you use the interface temporarily for message output, messages will not be printed while other print jobs are being printed.

## RepoutNr

| | | |
|---|---|---|
| Function | | Allows you to output a message number along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

Standard Mode

## RepoutDate

| | | |
|---|---|---|
| Function | | Allows you to output the date along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

## RepoutTime

| | | |
|---|---|---|
| Function | | Allows you to output the time along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

## RepoutAnzYear

| | | |
|---|---|---|
| Function | | Specifies how the date appears when the message is output. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Year with 2 digits |
| | 1 | Year with 4 digits |

## RepoutRepText

| | | |
|---|---|---|
| Function | | Displays the most recent serial message. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

Standard Mode

## Repout RepText21

| | | |
|---|---|---|
| Function | | Displays the most recent serial message beginning from the 21st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

## RepoutRepText41

| | | |
|---|---|---|
| Function | | Displays the most recent serial message beginning from the 41st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

## RepoutRepText61

| | | |
|---|---|---|
| Function | | Displays the most recent serial message beginning from the 61st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

Standard Mode

## RepmanQuitKey

| | | |
|---|---|---|
| Function | | Simulates the function of the Acknowledge key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Function of the Acknowledge key active |

You must edit the value of this variable with a function key or a button. You cannot use any other input form.

## RepmanChgMask

| | | |
|---|---|---|
| Function | | Lets you jump to the mask which is linked with the selected message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |

You must edit the value of this variable with a function key or a button. You cannot use any other input form.

## RepoutQuitText

| | | |
|---|---|---|
| Function | | Displays the most recent unacknowledged serial message. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

If the operator acknowledges the displayed message, the system automatically displays the next unacknowledged message.

Standard Mode

## RepoutQuitText21

| | | |
|---|---|---|
| Function | | Displays the most recent unacknowledged serial message beginning from the 21st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

## RepoutQuitText41

| | | |
|---|---|---|
| Function | | Displays the most recent unacknowledged serial message beginning from the 41st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

## RepoutQuitText61

| | | |
|---|---|---|
| Function | | Displays the most recent unacknowledged serial message beginning from the 61st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

Standard Mode

## RepoutQuitAnz

| | | |
|---|---|---|
| Function | | Displays the number of messages that still need to be acknowledged. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | |

## RepoutMarker

| | | |
|---|---|---|
| Function | | Indicates the current position of the messages within the message box. |
| Data type | | Numeric |
| Representation type | | Decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number, bar |
| Configurable values | 0 | The message with the highest priority is visible. |
| | 1 | Neither the message with the highest priority nor the message with the lowest priority is visible. |
| | 2 | The message with the lowest priority is visible. |
| | 3 | The message with the highest priority and the message with the lowest priority is visible. |
| | 4 | No message is visible within the message box. |

Standard Mode

## RepoutSelectGroup

| | | |
|---|---|---|
| Function | | Sets the group numbers whose messages are displayed. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0x01h to 0x80h | Group number 1 to 8 |

Each group is represented by one bit of a byte. A logical '1' in bit 0 activates group1, in bit 1 activates group2 and so on.

The settings for a message field override the settings for this system variable! To prevent the settings in the operating device from being overridden, you must activate the Global Settings function for the message field.

## RepoutSelectTime

| | | |
|---|---|---|
| Function | | Specifies the time rule according to which messages are displayed. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 | All messages in chronological order. |
| | 2 | All acknowledged messages that do not have the attribute "Disappear". |
| | 3 | All messages that do not have the attribute "Acknowledged". |

## RepoutGroup

| | | |
|---|---|---|
| Function | | Allows you to output a group number along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

Standard Mode

## 5.5.17.7 Parallel Message System

### RepmanSortCritP

| | | |
|---|---|---|
| Function | | Defines the sorting criteria for message output. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | By priority of message number |
| | 1 | In order of arrival (most recent first) |
| | 2 | In order of arrival (oldest first) |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

### RepoutNrP

| | | |
|---|---|---|
| Function | | Allows you to output a message number along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

### RepoutDateP

| | | |
|---|---|---|
| Function | | Allows you to output the date along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

Standard Mode

## RepoutTimeP

| | | |
|---|---|---|
| Function | | Allows you to output the time along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

## RepoutAnzYearP

| | | |
|---|---|---|
| Function | | Specifies how the date appears when the message is output. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Year with 2 digits |
| | 1 | Year with 4 digits |

## RepoutRepTextP

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

## Repout RepText21P

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 21st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

Standard Mode

## RepoutRepText41P

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 41st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

## RepoutRepText61P

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 61st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

## RepoutSelectGroupP

| | | |
|---|---|---|
| Function | | Sets the group numbers whose messages are displayed. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 256 | |

Each group is represented by one bit of a byte. A logical '1' in bit 0 activates group1, in bit 1 activates group2 and so on.

The settings for a message field override the settings for this system variable! To prevent the settings in the operating device from being overridden, you must activate the Global Settings function for the message field.

Standard Mode

### RepoutGroupP

| | | |
|---|---|---|
| Function | | Allows you to output a group number along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

## 5.5.17.8 Printer Control

### StopPrint

| | | |
|---|---|---|
| Function | | Stops the current print process. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Stops the print process. |

### BlockPrint

| | | |
|---|---|---|
| Function | | Starts to print the selected messages. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Starts the print process. |

Standard Mode

## PrintAllRep

| | | |
|---|---|---|
| Function | | Starts to print all of the serial messages. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Starts printing using the current formatting. |
| | 2 | Starts printing using all of the formatting options. |

## PrintAllState

| | | |
|---|---|---|
| Function | | Starts to print all parallel messages. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Starts the print process. |

## BlockPrintLong

| | | |
|---|---|---|
| Function | | Starts printing the selected messages using all of the formatting options. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Starts the print process. |

Standard Mode

## 5.5.17.9 Menu Control / Keys

### NewMask

| | | |
|---|---|---|
| Function | | Changes to the mask with the indicated number. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 to 9999 | Mask number |

### VarTablenR0

| | | |
|---|---|---|
| Function | | Creates a continuous numbering in tables, beginning with 0. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to n | |

### VarTablenR1

| | | |
|---|---|---|
| Function | | Creates a continuous numbering in tables, beginning with 1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 to n | |

### HardCopy

| | | |
|---|---|---|
| Function | | Loads the current mask image from the operating device to the PC. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Start upload |

Standard Mode

This system variable applies only to operating devices with a Z80-CPU with a firmware release **older** than version 6.3 (Hx00063x).

Connect the PC to the operating device using the download cable before starting the upload. Use a terminal program like e.g. HyperTerminal©.

## TabLeft

| | | |
|---|---|---|
| Function | | Is used to move to the left column of a table. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Move to left column |

## TabRight

| | | |
|---|---|---|
| Function | | Is used to move to the right column of a table. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Move to right column |

## TabPgUp

| | | |
|---|---|---|
| Function | | Is used to page up within a table. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Page up |

Standard Mode

## TabPgDn

| | | |
|---|---|---|
| Function | | Is used to page down within a table. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Page down |

## Shift

| | | |
|---|---|---|
| Function | | Enables alphanumerical character input. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state, only numerical input possible |
| | 1 | Upper-case alphanumerical character input enabled |
| | | |
| Key | | Letters (Characters) |
| 0 | | ( ) ° 0 |
| 1 | | S T U 1 |
| 2 | | V W X 2 |
| 3 | | Y Z % 3 |
| 4 | | J K L 4 |
| 5 | | M N O 5 |
| 6 | | P Q R 6 |
| 7 | | A B C 7 |
| 8 | | D E F 8 |
| 9 | | G H I 9 |
| Decimal point | | : ? ! . |
| Plus | | < = > + |
| Minus | | \ * / – |

Standard Mode

## ShiftCase

| | | |
|---|---|---|
| Function | | Enables alphanumerical character input. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state, only numerical input possible |
| | 1 | Upper case and lower case alphanumerical character input enabled |
| | | |
| Key | | Letters (Characters) |
| 0 | | ( ) ° 0 |
| 1 | | S T U s t u 1 |
| 2 | | V W X v w x 2 |
| 3 | | Y Z % y x % 3 |
| 4 | | J K L j k l 4 |
| 5 | | M N O m n o 5 |
| 6 | | P Q R p q r 6 |
| 7 | | A B C a b c 7 |
| 8 | | D E F d e f 8 |
| 9 | | G H I g h i 9 |
| Decimal point | | : ? ! . |
| Plus | | < = > + |
| Minus | | \ * / – |

## ShiftTouch

| | | |
|---|---|---|
| Function | | Displays the state of the shift mode. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

Standard Mode

## KeyCursLeft

| | | |
|---|---|---|
| Function | | Simulates the key function of the Cursor Left key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Cursor Left active |

## KeyCursRight

| | | |
|---|---|---|
| Function | | Simulates the key function of the Cursor Right key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Cursor Right active |

## KeyCursUp

| | | |
|---|---|---|
| Function | | Simulates the key function of the Cursor Up key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Cursor Up active |

## KeyCursDown

| | | |
|---|---|---|
| Function | | Simulates the key function of the Cursor Down key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Cursor Down active |

Standard Mode

## KeyHome

| | | |
|---|---|---|
| Function | | Simulates the key function of the Cursor Home key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Cursor Home active |

## KeyHelp

| | | |
|---|---|---|
| Function | | Simulates the key function of the Help key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Help active |

## KeyDot

| | | |
|---|---|---|
| Function | | Simulates the key function of the Decimal Point key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Decimal Point active |

## KeyClear

| | | |
|---|---|---|
| Function | | Simulates the key function of the Clear key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Clear active |

Standard Mode

## Key0

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '0'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 0 active |

## Key1

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '1'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 1 active |

## Key2

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '2'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 2 active |

## Key3

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '3'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 3 active |

Standard Mode

## Key4

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '4'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 4 active |

## Key5

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '5'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 5 active |

## Key6

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '6'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 6 active |

## Key7

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '7'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 7 active |

Standard Mode

## Key8

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '8'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 8 active |

## Key9

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '9'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 9 active |

## KeyPlus

| | | |
|---|---|---|
| Function | | Simulates the key function of the Plus key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Plus active |

## KeyMinus

| | | |
|---|---|---|
| Function | | Simulates the key function of the Minus key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Minus active |

Standard Mode

### KeyEnter

| | | |
|---|---|---|
| Function | | Simulates the key function of the Enter key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Enter active |

### KeyEdit

| | | |
|---|---|---|
| Function | | Simulates the key function of the Data Release key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Edit active |

## 5.5.17.10 Password

### MskChgPasswd

| | | |
|---|---|---|
| Function | | Variable for password input. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | 11 characters |

Standard Mode

## MskChgResPasswd

| | | |
|---|---|---|
| Function | | Deletes the currently entered passwordand resets the access authorization. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Delete password and reset access authorization |

## ChangePasswd

| | | |
|---|---|---|
| Function | | Changes a password. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | 11 characters |

## FlashPasswd

| | | |
|---|---|---|
| Function | | Resets the passwords to the values specified in the programming software. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Reset passwords |

Before you use this system variable, make sure to save the password with the highest-level access authorizations!

Standard Mode

## PasswdInactive

| | | |
|---|---|---|
| Function | | Deactivates password protection. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Password protection active, inactive during initial initialization |
| | 1 | Password protection active, edit and view level = 255 |

The value of the system variable is stored retentively. The stored value is automatically used again after a power failure.

## ActViewLevel

| | | |
|---|---|---|
| Function | | Displays the current view level. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | |

## ActEditLevel

| | | |
|---|---|---|
| Function | | Displays the current edit level. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | |

Standard Mode

## 5.5.17.11 Recipes

### SelectDSNr

| | | |
|---|---|---|
| Function | | Number of the current data set. |
| Data type | | Numeric |
| Representation type | | Selection text, decimal number |
| Configurable values | 0 to 250 | |

### SelectDSName

| | | |
|---|---|---|
| Function | | Name of the current data set. |
| Data type | | Alphanumeric |
| Representation type | | Selection Text |
| Configurable values | | 30 characters |

### DestDSNr

| | | |
|---|---|---|
| Function | | Number of the destination data set. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 to 250 | |

Standard Mode

## DSCopy

| | | |
|---|---|---|
| Function | | Copies the current data set to the destination indicated in DestDSNr. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Copy to destination in DestDSNr |
| | 2 | Automatically copy and search a free data set |
| | 3 | Copy to destination in DestDSNr and overwrite any data set existing |

## DSDelete

| | | |
|---|---|---|
| Function | | Deletes the current data set. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Deletes the active data set and activates the first data set of the recipe. |
| | 2 | Deletes all data sets of the current recipe and activates the default data set of the recipe. |

## ActDSName

| | | |
|---|---|---|
| Function | | Name of the current data set. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | 30 characters |

## SelectRezeptNr

| | | |
|---|---|---|
| Function | | Number of the currently active recipe. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | |

You can only enter the numbers of existing recipes. Invalid entries are ignored

## SelectRezeptName

| | | |
|---|---|---|
| Function | | Name of the current recipe. |
| Data type | | Numeric |
| Representation type | | Alphanumeric |
| Configurable values | | The programming software provides the texts automatically (30 characters). |

You can only select the names of existing recipes. The programming software automatically generates a text list with the names of existing recipes and links it to this system variable.

## DSDeleteState

| | | |
|---|---|---|
| Function | | Displays the status of the data set delete process. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Delete inactive |
| | 1 | Delete active (the current data set of the current recipe is deleted) |

Standard Mode

## LoadRezName

| | | |
|---|---|---|
| Function | | Name of the last recipe transferred. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Up to 30 characters<br>If the recipe was deleted after being transferred, a number of question marks '????' are displayed instead of the name. |

## DSDownload

| | | |
|---|---|---|
| Function | | Loads the current data set to the controller. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Loads the content of the recipe buffer to the controller. |
| | 2 | Loads the content of the single variable to the controller. |

## DSDnloadBreak

| | | |
|---|---|---|
| Function | | Ends the data set transfer currently in progress. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Stop data set transfer |

Standard Mode

## DSDnloadState

| | | |
|---|---|---|
| Function | | Displays the status of the data set transfer to the controller. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Data set transfer is requested, but not yet released by the controller. |
| | 2 | Data set transfer in progress |

## LoadDSName

| | | |
|---|---|---|
| Function | | Name of the last data set transferred. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Up to 30 characters<br>If the data set was deleted after being transferred, a number of question marks '????' are displayed instead of the name. |

## StartSave

| | | |
|---|---|---|
| Function | | Loads data sets to the PC. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Transfers a single data set to the PC |
| | 2 | Transfers all data sets of a recipe to the PC |
| | 3 | Transfers all data sets to the PC |

Standard Mode

## SaveState

| | | |
|---|---|---|
| Function | | Displays the status of the data set transfer to the PC. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Transfers a single data set. |
| | 2 | Transfers all data sets of a recipe. |
| | 3 | Transfers all data sets in the operating device |

## StartRestore

| | | |
|---|---|---|
| Function | | Controls the transfer process from the PC to the operating device. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Activate ready-to-receive |
| | 2 | Stop transfer |

## RestoreState

| | | |
|---|---|---|
| Function | | Displays the status of the data transfer to the operating device. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Data transfer in progress |

Standard Mode

## RestoreLineNr

| | | |
|---|---|---|
| Function | | Current line number in the data set file. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | 1 to 255 |

## StartRezPrint

| | | |
|---|---|---|
| Function | | Starts printing a data set. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Start printing |
| | 2 | Stop printing |

## RezPrintState

| | | |
|---|---|---|
| Function | | Displays the status of the data set print process. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Printing in progress |

Standard Mode

## StartUpload

| | | |
|---|---|---|
| Function | | Loads the data set which is currently active in the controller to the operating device. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Loads one variable at a time to the destination indicated in UploadDSNr. |
| | 2 | Loads variables as a block from the recipe buffer to the destination indicated in UploadDestNr. |
| | 3 | Loads one variable at a time and saves them automatically to a free data set. System message 18 is displayed if no free data set is available. |
| | 4 | Loads variable as a block from the recipe buffer and saves them automatically to a free data set. System message 18 is displayed if no free data set is available. |

## UploadDSNr

| | | |
|---|---|---|
| Function | | Number of the destination data set for the upload. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 to 250 | |

## UploadState

| | | |
|---|---|---|
| Function | | Displays the status of the data set upload. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Upload active |

Standard Mode

## 5.5.17.12 Running Time Meters

### Counter1 to Counter8

| | | |
|---|---|---|
| Function | | Running time meter 1 to 8. The counter is incremented when the bit is set. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | 0 to 4.294.967.295 |

The function of the Running Time Meter is dependent on other parameters.
See chapter “Running Time Meter“ on page 5-117.

## 5.5.17.13 Loop-Through Operation

### Pg2Sps

| | | |
|---|---|---|
| Function | | Enables/disables the loop-through mode. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Upload active |

Provisions must be made to be able to use the loop-through operation with the PG protocol !

Standard Mode

### Pg2SpsState

| | | |
|---|---|---|
| Function | | Displays the status of the upload process of the loop-through mode. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Request loop-through mode |
| | 2 | Loop-through mode is possible |
| | 3 | Loop-through mode active |

## 5.5.17.14 Loadable Character Set

### ChrsetName

| | | |
|---|---|---|
| Function | | Displays the name of the current character set. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Default (character set NORMAL or ZOOM used for display) |
| | | Character set name (user-created character sets used for display) |

## 5.5.17.15 Maintenance

### User1 bis User5

| | | |
|---|---|---|
| Function | | For free use. |
| Data type | | Alphanumeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | Any, up to 16 bit |

The data is stored retentively in the operating device. The stored value is automatically used again after a power failure.

Standard Mode

## LCDADCInput

| | | |
|---|---|---|
| Function | | Current input value of the AD converter for contrast control. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | |

## LCDDACOutput

| | | |
|---|---|---|
| Function | | Current input value of the DA converter for contrast control. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | |

## Break

| | | |
|---|---|---|
| Function | | Cancels the current input process. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Cancel input process |

The input values are not transferred to the controller!

Standard Mode

## StartCalibrationTouch

| | | |
|---|---|---|
| Function | | Starts the calibration process for the touch-screen. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Starts the calibration process |

Once you have set the system variable to the value 1, the next two touch screen touches are used for calibration! You must set up the system variable **StateCalibrationTouch** to ensure that operators will know how to proceed.

## StateCalibrationTouch

| | | |
|---|---|---|
| Function | | Displays the calibration status. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Touch to calibrate (the operator starts the calibration process with the next touch) |
| | 1 | Touch left pixel (the operator needs to touch a specific coordinate at the top left) |
| | 2 | Touch right pixel (the operator needs to touch a specific coordinate at the lower right) |
| | 3 | Calibration successful (calibration process complete) |

For the user interface, we recommend that you create a text list or an image list, and that you present the instructions to the operator as selection text or a selection image.

## MaskStartupTime

| | | |
|---|---|---|
| Function | | Displays how much time (in milliseconds) has elapsed for mask build-up. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | --- | Milliseconds |

Standard Mode

### KeyResponseTime

| | | |
|---|---|---|
| Function | | Shows how much time (in milliseconds) elapses to modify a variable in the controller. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | --- | Milliseconds |

You can use this system variable only with touch panels.

## 5.5.17.16 Editors

### EditInvers

| | | |
|---|---|---|
| Function | | Displays the variable inverse while it is edited. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Not inverted |
| | 1 | Inverted |

### EditEnter

| | | |
|---|---|---|
| Function | | Controls the cursor when the Enter key is pressed. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Cursor changes to the next input variable |
| | 1 | Cursor remains at the current position |

Standard Mode

### StatePerm

| | | |
|---|---|---|
| Function | | Displays the status of the status-LED for the data release. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Status-LED OFF |
| | 1 | Status-LED ON |
| | 2 | Status-LED FLASHING |

## 5.5.17.17 Help

### StateHelp

| | | |
|---|---|---|
| Function | | Displays the status of the help status-LED. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Status-LED OFF |
| | 1 | Status-LED ON |
| | 2 | Status-LED FLASHING |

### Message

| | | |
|---|---|---|
| Function | | Displays the current system message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 to 29 | Number of the system message |

To prevent a system message from being issued, you must delete the message text for the system message. This means, however, that the system message will not appear in any display forms.

Standard Mode

## QuitMessage

| | | |
|---|---|---|
| Function | | Acknowledge the system message which is currently displayed. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Status-LED OFF |
| | 1 | Status-LED ON |
| | 2 | Status-LED FLASHING |

For operating devices equipped with a keyboard, this function is permanently linked with the Help key. There are a number of options for acknowledging a system message for touch-screen-operated operating devices.
See chapter “Buttons“ on page 5-109.

## StatusText

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

## StatusText21

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 21st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

Standard Mode

### StatusText41

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 41st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

### StatusText61

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 61st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

## 5.5.17.18 Print Logs

### SelectPrintLog

| | | |
|---|---|---|
| Function | | Number of the currently selected print log. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | |

Standard Mode

## StartPrintLog

| | | |
|---|---|---|
| Function | | Starts to print the currently selected print log. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Start printing |
| | 2 | Stop printing |

## StatePrintLog

| | | |
|---|---|---|
| Function | | Status of the current print process. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Ready |
| | 1 | Printing in progress |
| | 2 | Print process stopped by operator |
| | 3 | Error while printing |

## PageNumber

| | | |
|---|---|---|
| Function | | Current page of the current print job. Can be combined with the representation type "Bar" to create a progress indicator. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | |

Standard Mode

## 5.5.17.19 Compact Flash Card

Small operator terminals of the VCP type can only use Compact Flash cards formatted as FAT16. By default, the Windows XP® operating system formats Compact Flash cards in FAT32 format! Make sure to change the settings to activate the FAT16 format when formatting a Compact Flash card using Windows XP®!

### CardFileName

| | | |
|---|---|---|
| Function | | Name of a file which you want to access in write mode or read mode. Enter the file name including the file extension. The file name cannot exceed a length of 40 characters including the dot and the file extension! |
| Data type | | Alphanumeric |
| Representation type | | Selection Text |
| Configurable values | | |

You can display the content of the Compact Flash card using this system variable. The items for the text list are generated automatically.

### CardApplicationMove

| | | |
|---|---|---|
| Function | | Starts a firmware update from the Compact Flash card. The name of the S3 file must be entered in the system variable **CardFileName**. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Start firmware update |

Standard Mode

## CardDataSetMove

| | | |
|---|---|---|
| Function | | Starts the transfer of data sets from the Compact Flash card to the operating device or vice versa. To be able to transfer data sets **from** the **Compact Flash** card to the operating device, the name of the data set must be entered in the system variable **CardFileName**. All of the data sets of the current recipe are transmitted during the transfer from the operating device to the Compact Flash card. The first 20 characters of the data set name are used as a file name. The file has the extension **.TXT**. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Transfer to the Compact Flash card |
| | 2 | Transfer to the operating device |

## CardFileDelete

| | | |
|---|---|---|
| Function | | Deletes the file specified in the system variable **CardFileName** from the Compact Flash card. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Deletes the file from the Compact Flash card. |

Standard Mode

# CardFileError

| | | |
|---|---|---|
| Function | | Displays errors that occurred while using the Compact Flash card. The error number has different meanings depending on the type of operating device. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Possible Values for TesiMod operating devices | 0 | No error |
| | 1 | No Compact Flash card inserted. |
| | 2 | The specified file does not exist on the Compact Flash card or cannot be read. |
| | 3 | The Compact Flash card is full or write-protected. |
| | 4 | The file already exists on the Compact Flash card. |
| | 5 | The file has the wrong data type (.S3 for application and Firmware, .TXT for data sets) |
| | 6 | The S3 file was generated for another operating device. Select a different S3 file or generate a new S3 file for the corresponding operating device. |
| | 7 | The S3 file is for an operating device equipped with a different memory size. Select a different S3 file or generate a new S3 file for the corresponding operating device. |
| | 8 | The Compact Flash card was detected. |

Standard Mode

### CFCardError

| | | |
|---|---|---|
| Function | | Displays errors that occurred while using the Compact Flash card. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No error |
| | 1 | No Compact Flash card in device. |
| | 2 | The requested file does not exist on the Compact Flash card. |
| | 3 | The Compact Flash card is full or write-protected. |
| | 4 | The file already exists on the Compact Flash card. |
| | 5 | File has the wrong file extension. |
| | 6 | S3 file is for the wrong device type. |
| | 7 | S3 file is for the wrong memory type. |
| | 8 | The Compact Flash card was detected. |

## 5.5.17.20 Set of Curves (Graph)

### DataLogTrig

| | | |
|---|---|---|
| Function | | Release a trigger event for a data logger. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Trigger for data logger 1 |
| | 2 | Trigger for data logger 2 |
| | 3 | Trigger for data logger 3 |
| | 4 | Trigger for data logger 4 |

Standard Mode

### DataLogClear

| | | |
|---|---|---|
| Function | | Erase the memory of a data logger |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Erase the memory of data logger 1 |
| | 2 | Erase the memory of data logger 2 |
| | 3 | Erase the memory of data logger 3 |
| | 4 | Erase the memory of data logger 4 |

## 5.5.17.21 Sound

### Volume

| | | |
|---|---|---|
| Function | | Volume of the loudspeaker. Only for Dornier MedTech. devices. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 15 | 0 = low15 = high |

## 5.6 Dynamic Attributes

For the mask elements Static Text, Text Field, and Variable, you can assign 255 ranges of values for dynamic attributes.

Dynamic attributes change the display of a text or variable value in the operating device, based on a variable or control variable value.

You can display up to 25 objects with dynamic attributes in a mask.

The system displays the values for the upper and lower limit in a list box. In the same line, it displays the attributes for values that are within the limits. You cannot enter overlapping value ranges!

1. Enter the values for the upper and lower limit under the list box.
2. Select the corresponding attributes in the relevant check boxes.
3. Assign the attributes to the range of values. The range of values and its attributes are simultaneously entered in the list box.

The dynamic attributes are either derived directly from the value of a variable or from the value of a corresponding control variable.

For variables in input and output masks, the entry of a control variable is optional.

In general, no control variables are permitted in recipes. Here, the dynamic attributes can only be derived from the value of the variables.

For texts in input/output masks, a control variable is always required to control the attributes.

You cannot assign dynamic attributes for texts in recipes.

To assign dynamic attributes, carry out the following steps:

1. Click one of the lines in the list box.
2. Enter limit values into the appropriate fields.
3. Select the corresponding attributes.
4. Enter the name of the control variable, if needed.
5. Click the Assign button.

You can assign the following attributes:

- Underline
- Inverse
- Flashing
- Invisible
- Non-editable
- Foreground
- Background

## 5.6.1 Underline

You can assign the (dynamic) attribute **Underline** to variables and static texts.

Fig. 5-30: Text with the Underline attribute

## 5.6.2 Inverse

You can assign the (dynamic) attribute **I**nverse to variables and static texts. This format is particularly suitable if you want to emphasize the variable that is currently selected.

Fig. 5-31: Text with the Inverse attribute

## 5.6.3 Flashing

You can assign the (dynamic) attribute **Flashing** to variables and static texts. Note that an element that is assigned this attribute is displayed in the strikethrough format and not as flashing text.

Fig. 5-32: Text with the Flashing attribute

## 5.6.4 Invisible

You can assign the dynamic attribute **Invisible** to variables and static text, to ensure that they do not appear below or above specific controller values.

## 5.6.5 Non-Editable

You can assign the dynamic attribute **Non-Editable** to variables, to ensure that they cannot be changed below or above specific controller values.

## 5.6.6 Foreground

You can assign the (dynamic) attribute 'Foreground' to variables and static text, to ensure that they are (when values are below or above specific controller values) are displayed with a specific color.

Standard Mode

## 5.6.7 Background

You can assign the (dynamic) attribute 'Foreground' to variables and static text, to ensure that they are (when values are below or above specific controller values) are displayed in front of a specific background.

## 5.6.8 Attribute Priorities

1. First, the attributes of the variable or text set in the normal dialog box for the mask element are used.
2. If a control variable exists, its value and the range of values definition are used to define the dynamic attribute.
3. If no control variable exists, the value of the PLC variables and the range of values definition are used to determine the dynamic attribute. (Not in the case of static texts).
4. If value-specific attributes were defined in the text list for selection texts, these attributes are used.

Standard Mode

## 5.7 Set of Curves (Graph)

You use sets of curves to graphically display the values that are recorded by one or more data loggers.

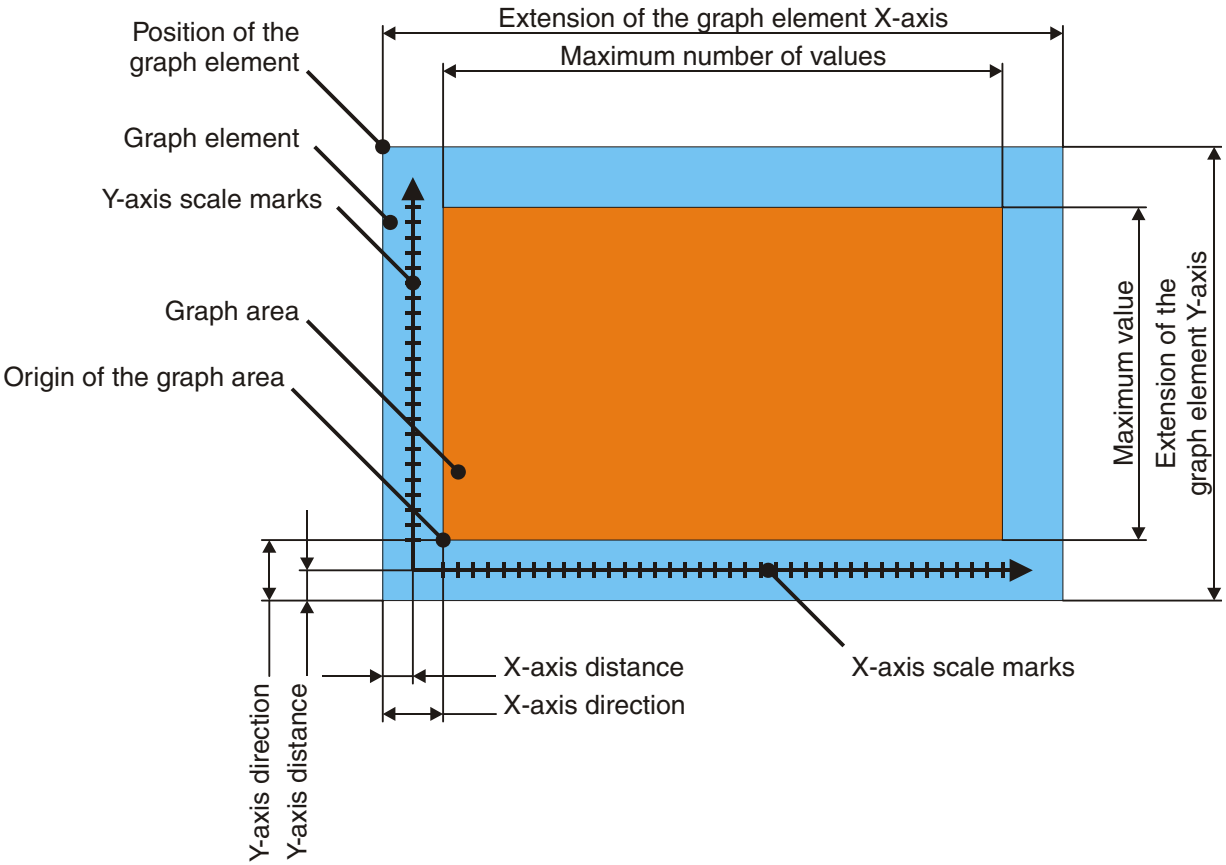


Fig. 5-33: Structure of a set of curves

### 5.7.1 Data Logger

You can program four independent data loggers.

The data loggers record cyclical or event-driven values between 0 and 254 from the controller. These values are displayed graphically in a set of curves.

For each data logger, you assign a name and a byte address in the controller.

You can specify a recording type for each data logger:

- Plotter continuous (single values): The plotter moves over the output area and, in doing so, outputs the values (like an oscilloscope).
- Plotter static (single values): The curve is drawn continuously from the left or right edge (like an ECG plotter).
- Flash light (all values): The values for the curve are read as a snapshot from the controller and displayed in full (copy of all data at a point in time)

The number of data points must be specified for the horizontal direction.

You can also select the display orientation.

## 5.8 Images

You can use images as:

- Background images in masks
- Content for image lists that represent variable values
- Icons for internal error messages
- Images for buttons
- A frame for buttons

You can import images or embed them as objects.

All images that you create are available in the programming software at the location where you can work with images.

Double-click an embedded object to open the application program that you used to create the object. You can now edit the object directly. The system enters the changes to the object into the programming software after you close the application.

## 5.9 Symbols

Symbols are images with two colors that are displayed on touch screen operating devices.

The advantage of using symbols is that you can customize the foreground and background color. If symbols are used in buttons, the colors of the icon are determined depending on the color settings of the button (for example, you can program a button to change color when it is pressed).

It is also easy to reuse symbols as the color is determined by the button or the background.

Standard Mode

## 5.10 Buttons

Buttons are graphic areas that are linked with a specific function. When you press a button, the preconfigured function is activated. This only applies to operating devices equipped with a touch screen. On operating devices with a full graphics display, buttons can only be used to display images, variables or texts.

A button can be broken down into the following:

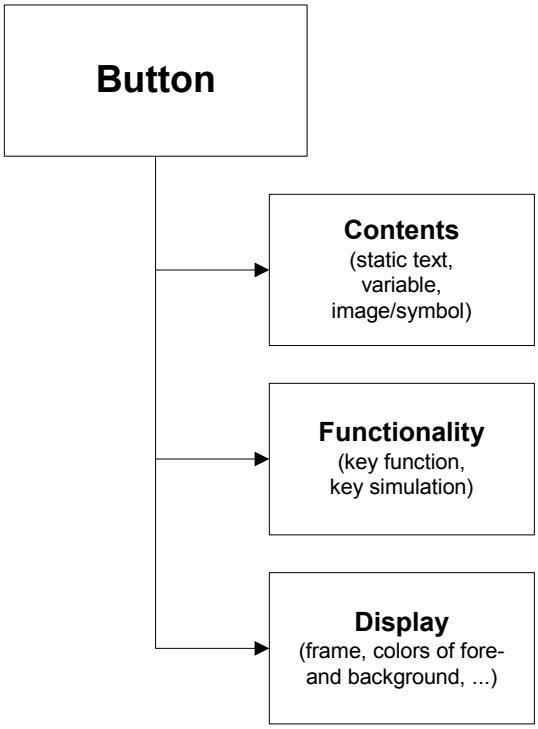


Fig. 5-34: Button

The button content, the functions and the representation (display frame, other attributes) can, for the most part, be programmed independently of each other.

### 5.10.1 Content of Buttons

A button can contain a static text, a text field, a mask variable, an image/symbols or nothing at all.

Buttons that have no content are displayed without a frame and are transparent mask elements. (Application: Transparent buttons are superimposed on a background image, for example, a plant overview to map “hot areas“ on an image. When you select this area, a specific action is carried out, for example, the system opens another mask).

## 5.10.2 Functions of Buttons

A button can trigger the following functions:

- Open another mask
- Write a value (byte) to a PLC or system variable when you press the button
- Write a value (byte) to a PLC or system variable when you release the button
- Simulate any key
- Generate a free tone
- Activate or open the Editor for an input variable
- No action

## 5.10.3 Representation of Buttons

Attributes for displaying a button are:

– Foreground and background color for the pressed and released states
– Position and dimension of the button
– Frame for the pressed and released states

Note:

- When you program an input variable in the same way as for a keyboard-operated operating device, a button is automatically generated around the variable.
- Buttons can only overlap with background images.
- Buttons in tables that contain a variable have no frame and have one line.
- Buttons in input and output masks are not allowed to contain any input variables.
- When you program a button with an input variable of the type Selection Text or Selection Image, the **Enter** button is automatically created (on request). In other words, no input or output mask is linked for both of these types. The user presses the button to navigate in the corresponding list. If the selection text variable only has one line, the variable value is decremented when you press the left half of the button, and incremented when you select the right half. For multi-line selection text variables and for selection image variables in general, the variable value is decremented when you press the top half of the button, and incremented when you press the bottom half.

The following image depicts a button that has a horizontal layout.

This type is activated for selection text that only has one line.

Fig. 5-35: Button with horizontal layout

The following image depicts a button that has a vertical layout.

This type is activated for selection texts and selection images with several lines.

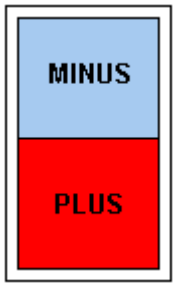


Fig. 5-36: Button with vertical layout

### 5.10.3.1 Frames for Buttons

The frame for a button is created as an image that is saved in the programming software as an image. This image is then made available by the programming software, and you can use it for button frames.

In the following example, a frame is created that depicts a button when it is not pressed (released state).

The image for this frame looks like this:

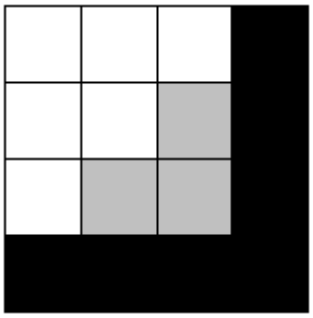

Fig. 5-37: Image for a basic frame

This image is made up of four subareas.

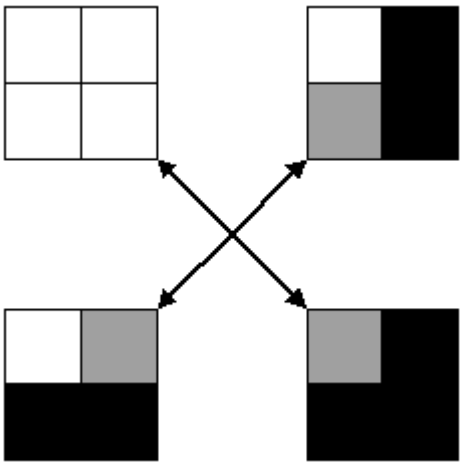

Fig. 5-38: Image split into four areas

The programming software automatically splits an image into these four areas.

The pixels for the edges are then determined and inserted a number of times, depending on the dimension of the button.

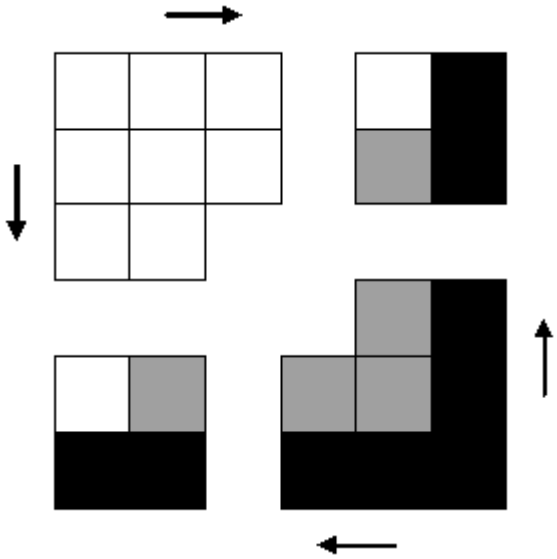

Fig. 5-39: Determining and expanding frame edges

In this context, only the top left and bottom right corners are taken into account. For the following image, each frame edge has been expanded by two pixels.

Standard Mode

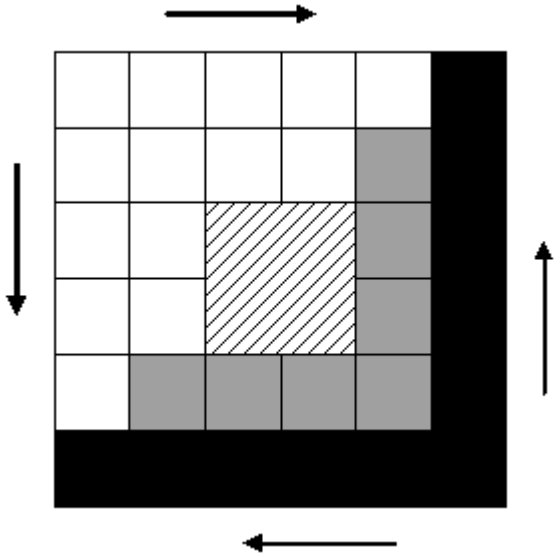

Fig. 5-40: Button: Final result

The arrows in the image illustrate the directions in which the pixels are inserted for the frame edges.

The hatched area depicts the button's usable area. Texts, variables, and images are displayed here. You can assign a background color to this area.

You can use the formats bit map (BMP), device-independent bit map (DIB), Windows Metafile (WMF) or Enhanced Metafile (EMF) to create images.

## 5.11 Function Keys/Softkeys

Another important feature, in addition to the masks, are the function keys and their LEDs. Function keys are user-programmable. They can be used as direct selector keys to switch to another mask or as control keys for the machine. When used as control keys, the integrated LEDs provide feedback information.

Programming the function keys as direct selector keys allows fast, direct access to the masks as well as to entire menu structures.

If the operating device is fitted with parallel outputs, any eight function keys can be assigned to the outputs directly. The reaction time after pressing a key is approximately 30 ms. Before a function key signal is provided, the terminal debounces the key, thereby ensuring that it has actually been 'pressed'.

In the programming system, the combination of direct selection and control function can be programmed for function keys and for soft keys. Only the press codes of the keys should be evaluated in this mode of operation. This is because, depending on the length of time the key is pressed and the nature of the assigned mask, the stop code may have already changed!

## 5.11.1 Direct Selector Keys

Direct selector keys are function keys programmed to directly call up a specific mask. Pressing this function key thereby allows you to directly change to another mask.

This change of mask is not possible if the data release has been requested (status LED in the Data Release key is flashing or lights up) in a mask without automatic data release.

Direct selector keys allow speedy and convenient operation.

## 5.11.2 Function Keys in the Controller

In addition to programming function keys as direct selector keys, they can be programmed to carry out a function in the controller. To do this, instead of assigning a mask change to a function key, assign it the symbolic name of a controller variable in the application description.

When you press the key, it can set or reset the variable, and the same functions are assigned to it when you release the key. If you assign the set function to the key, the value entered is assigned to the data type.

In other words:

If the digit 1 is entered as the value:

- A flag bit receives logical 1
- A flag byte receives the value 01h
- A flag word receives the value 0001h
- A double word receives the value 00000001h

For values greater than 1, you must specify at least a byte address for the variable.

## 5.11.3 Softkeys

Soft keys are function keys that carry out a different function, depending on the mask in which the appear. The current function of a soft key is described in the current mask. In this context, you can use images, background images, selection images, static texts, and selection texts.

Standard Mode

If you use a selection text to label soft keys, you can use the function key for several functions within a mask.

The action to be performed is determined by the:

- Mask number
- Number of the selection text
- Variable value transferred with the softkey.

Depending on the operating device, the number of keys you can use as soft keys varies.

**Example:**

We want a softkey (F1) in mask 10 to be able to switch a pump on and off.

1. Create a text list (pump) with two entries.

| Value | Text |
|---|---|
| 0 | Switch Pump OFF |
| 1 | Switch Pump ON |

Fig. 5-41: Text list for example softkey.

2. Define the variables.

| Symbolic Name | Address (Example) |
|---|---|
| Soft Key Labeling | M100.0 |
| Softkey Status | M100.1 |
| Mask Image | MW110 |

Fig. 5-42: Variables for example softkey.

3. Create the mask (number 10).

Set up a controller variable (M 100.0) next to or above a function key.

Link the controller variable with the representation type Selection Text for cyclical output with the text list (pump).

Link the function key F1 of the mask with the variable Soft Key Status (M 100.1), (set/reset).

4. Create the controller program to perform the following: Output A32.0 is to be used to control the pump.

Evaluate the mask number (MW 110); (must have the value 10).

Evaluate the edge for M 100.1.

Create a ELTACO function for pump output A32.0.

Use it to set flag M 100.0 to 0 when the pump is on.

Use it to set flag M 100.0 to 1 when the pump is off

## 5.11.4 Reaction Time of Function and Soft Keys

Whenever function keys need to influence PLC variables, they are given highest priority when transferred via the protocol. The reaction times during the transfer procedure are protocol-specific and range from 60 to 120 ms. This is the period of time which elapses after a key has been pressed until an output is set or reset in the PLC. The reaction time varies depending on the protocol itself, the load on the protocol (cyclical data, etc.) and the cycle time of the PLC.

Note that reaction times can be influenced by the polling times of the variables, messages and images of the LEDs.

## 5.11.5 Using Control Keys as Function Keys

Control keys can alternatively be used as function keys to trigger certain actions in the PLC. They can be defined to carry out the same functions as function keys, i.e. they are capable of assigning any values to a variable. The transfer procedure is independent of the mask parameter assignment. Thus, if a control key is to carry out a specific function in a mask, it should not be programmed as a ‘mask selector key’ at the same time. The mask-specific evaluation is identical to that of the function key.

## 5.11.6 Function Keys Controlling Parallel Outputs

Groups of eight function keys can be linked to parallel outputs (semiconductor outputs). The keys are read in by the software, debounced and then mapped to the outputs. The reaction time to the outputs is around 30 ms. The parallel output option offers users the advantage that the keys act on the PLC very quickly and independently of the protocol. They are ideal for controlling axes or for programming jogging mode!

The power output allows direct control of PLC inputs.

If a PLC variable has been programmed for the function key in addition to the output, it is of course also sent to the controller, though with a small time delay.

Standard Mode

## 5.11.7 Status LEDs of Function Keys

For each function key status LED, a 2-bit piece of information is available in the cyclical polling area. One bit activates or deactivates the corresponding status LED, the other bit displays the flashing attribute of the status LED. The status LEDs can only be influenced by the controller.

See chapter “CFCardError“ on page 5-102.

The following exceptions apply:

- You have programmed a function key as a direct selector key for a message mask
- You have entered a value greater than 0 (zero) as the message priority.

In these cases, the status LED of this function key cannot be influenced by the controller! In these situations, the status LED can only be controlled using the message functions.

If the operating device you are using has less status LEDs than can be controlled here, the superfluous bits have no function.

To minimize the transfer times, select the length of the polling area so that only the bytes required for status LEDs are transferred.

## 5.12 Running Time Meter

Each operating device has 8 running time meters.

**Control Byte**

Each running time meter is assigned a bit in the control byte. Using the control byte, the controller can influence the running time meters in the operating device.

If bit X is set in the control byte when polling is carried out, the running time meter X is incremented. In each case, the value of the running time meter is stored in the system variable CounterX.

| Bit | Counter | System Variable |
|---|---|---|
| 0 | 1 | Counter1 |
| 1 | 2 | Counter2 |
| 2 | 3 | Counter3 |
| 3 | 4 | Counter4 |
| 4 | 5 | Counter5 |

Fig. 5-43: Control byte of the running time meter

| Bit | Counter | System Variable |
|---|---|---|
| 5 | 6 | Counter6 |
| 6 | 7 | Counter7 |
| 7 | 8 | Counter8 |

Fig. 5-43: Control byte of the running time meter

**Reset Byte**

Each running time meter is assigned a bit in the reset byte. Using the reset byte, the controller can reset the running time meters in the operating device.

If bit X is set in the reset byte when polling is carried out, the running time meter X is reset to 0.

| Bit | Counter | System Variable |
|---|---|---|
| 0 | 1 | Counter1 |
| 1 | 2 | Counter2 |
| 2 | 3 | Counter3 |
| 3 | 4 | Counter4 |
| 4 | 5 | Counter5 |
| 5 | 6 | Counter6 |
| 6 | 7 | Counter7 |
| 7 | 8 | Counter8 |

Fig. 5-44: Reset byte of the running time meter

**Polling Time**

You use the polling time to specify the time intervals at which the operating device reads from the controller the variables for the control byte and the reset byte.

The running time meters are activated in the operating device as soon as you have entered a variable name for the control byte and specified a value for the polling time. If the polling time is 0 or if there is no address for the control byte, the Running Time Meter function in the operating device is off.

**Transferring counter value**

For each running time meter, you can enter a variable name in the controller. The operating device stores the value of the corresponding running time meter if the controller requests that the operating device to do so.

For this purpose, the controller writes the hexadecimal code **7FCF** into the serial message channel of the polling area.

For each variable, a 32-bit memory area must be available in the controller!

Standard Mode

**For example:**

You want to set up a running time meter for a maintenance interval of 50 hours. The polling time for the counter = 60 seconds (the counter increases by one each minute).

| | | |
|---|---|---|
| System Variable | Counter1 | |
| Representation Type | Decimal Number | |
| Format | Field length | 4 |
| | Fractional digits | 1 |
| | Only positive | |
| Scaling | Factor | 1 |
| | Divisor | 6 |
| | Addend | 0 |

After 150 polling cycles, the operating device displays a value of 2.5 hours.150 / 6 + 0 = 25Using the format 'Fractional Digits=1', the value 25 is displayed as 2.5!This example has a precision of +/- 6 minutes.

## 5.13 Read Coordination Byte

The Read Coordination byte is used for handshake and data coordination with the controller.

If necessary, the controller reads the Read Coordination byte and evaluates the individual bits.

| **Bit** | **Abbreviation** | **Function** |
|---|---|---|
| 0 | EA | Editing Request |
| 1 | EZ | Editing Status |
| 2 | RA | Refresh Request |
| 3 | LM | Liveness Flag |
| 4 | DDA | Data Set Download Active |
| 5 | | Not used |
| 6 | | |
| 7 | | |

Fig. 5-45: Structure of the Read coordination byte

The Read Coordination byte only works together with the Write Coordination byte.

## 5.13.1 Editing Request

The operating device uses the Editing Request bit to indicate to the controller that the value of a variable will be changed.

For this purpose, the operating device writes a logical 1 to the **Editing Request** bit in the Read Coordination byte.

To allocate an editing release to the operating device, the controller writes a logical 1 to the Editing Release bit in the Write Coordination byte.

## 5.13.2 Editing Status

The operating device uses the Editing Status bit to indicate to the controller that the value of a variable could be changed.

Once the operating device has received the Editing Release from the controller, the device sets the **Editing Status** bit in the Read Coordination byte to logical 1.

The operator can now change the variable value. To send the changed variable value to the controller, the operator must select the **Enter** key to complete the entry**.**

The operator can then change other variable values.

Then, the operator must press the **Data Release** key. This resets the **Editing Status** bit to logical 0.

The **Refresh Request** and **Refresh Acknowledgment** bits are used to write the new variable value to the controller.

Once the controller has read the new variable value, it uses the **Refresh Acknowledgment** bit to indicate of the Write Coordination byte that the **Editing Status** bit can once again be reset to logical 0.

## 5.13.3 Refresh Request

If you changed a variable value in the operating device, and selected the Data Release key, the **Refresh Request**bit in the Read coordination byte must be set to logical 1.

This triggers the read process in the controller, and then confirms it with the **Refresh Acknowledgment** bit in the Write Coordination byte.

Standard Mode

## 5.13.4 Liveness Flag

In some communication protocols, you cannot control the operability of the interface in the controller. The **Liveness flag** has been developed to address this shortfall. This is a simple function, which has proven very effective in practice.

Whenever the controller needs to know whether the connection is still active, it writes a logical 1, and subsequently a logical 0, to bit 3 of the Write Coordination byte.

The operating device constantly monitors the Liveness flag in the Write Coordination byte and compares it with the status of the Liveness flag in the Read Coordination byte. As soon as the two bytes are no longer the same, the operating device copies bit 3 from the Write Coordination byte to the Read Coordination byte.

Within a timeout time, the controller must now also check whether both statuses are identical.

When you determine the timeout time, remember to take the transfer times and polling times into account.

## 5.13.5 Data Set Download Active

As soon as the operating device transfers a data set to the controller, it writes a logical 1 to the Data Set Download Active bit. After all data were sent, the operating device writes a logical 0 to the Data Set Download Active bit. The controller can now work with the new data set values.

## 5.14 Write Coordination Byte

The term Write Coordination byte indicates that the controller writes this byte.

The Write Coordination byte is only read by the operating device. This byte is used together with the Read Coordination byte for the handshake and data coordination with the controller.

Here, the controller indicates its current status to the operating device.

The individual bits are independent of each other.

| Bit | Abbreviation | Function |
|---|---|---|
| 0 | ED | External Data Release |
| 1 | RQ | Refresh Acknowledgment |
| 2 | PL | Delete Password |
| 3 | LM | Liveness Flag |
| 4 | DDF | Data Set Download Release |
| 5 | | Free |
| 6 | | |
| 7 | | |

Fig. 5-46: Structure of the Write coordination byte

The Write Coordination byte only works together with the Read Coordination byte.

## 5.14.1 External Data Release

The controller can use the External Data Release bit to influence data release in the operating device. If the operator would like to change a value in the operating device, he must first request data release. For this purpose, the operating device writes a logical 1 to the Editing Request bit in the Read Coordination byte. During this time, the Data Release status LED flashes.

Once the controller establishes that the Editing Request bit in the Read Coordination byte is set to logical 1, it can release the editing process in the operating device by setting the External Data Release bit in the Write Coordination byte to logical 1. The Data Release status LED is then lit.

## 5.14.2 Refresh Acknowledgment

Once the controller has read the Refresh Request bit in the Read Coordination byte as logical 1, it can read in the changed variable value. When finished, the controller can write a logical 1 to the Refresh Acknowledgment bit, and confirm execution to the operating device.

## 5.14.3 Delete Password

When the operator exits a mask for which he requires a password for access, password protection needs to be activated again for this mask. This can be forced by the controller by entering a logical 1 in the Delete Password bit.

## 5.14.4 Liveness Flag

In some communication protocols, you cannot control the operability of the interface in the controller. The **Liveness flag** has been developed to address this shortfall. This is a simple function, which has proven very effective in practice.

Whenever the controller needs to know whether the connection is still active, it writes a logical 1, and subsequently a logical 0, to bit 3 of the Write Coordination byte.

The operating device constantly monitors the Liveness flag in the Write Coordination byte and compares it with the status of the Liveness flag in the Read Coordination byte. As soon as the two bytes are no longer the same, the operating device copies bit 3 from the Write Coordination byte to the Read Coordination byte.

Within a timeout time, the controller must now also check whether both statuses are identical.

When you determine the timeout time, remember to take the transfer times and polling times into account.

## 5.14.5 Data Set Download Release

The controller determines the start time of a data set transfer from the operating device to the controller by writing a logical 1 in the Data Set Download Release bit.

## 5.15 The Cyclical Polling Area

The cyclical polling area is a freely definable memory area in the controller.

The controller writes to this memory area.

The operating device polls this memory area cyclically. In other words, it reads the content in regular intervals.

The polling area is created in a byte-oriented or word-oriented manner.

The controller must be able to access this memory area bit-by-bit, and the memory area must be continuous.

The operating device accesses this memory area byte-by-byte or word-by-word.

The polling area is broken down into three zones:

1. Write Coordination byte (1 byte)
2. Serial message channel (2 bytes – high byte and low byte)
3. Control bytes for the status LEDs of the function keys (number depends on the operating device type)

You must enter the starting address for the polling area in the system parameters for the polling area.

Here, enter the length of the polling area and the polling time as well.

The length of the polling area is based on the number of status LEDs on the operating device that is being used.

The polling time is based on the total system load. Note the cycle times for other variables!

The structures of byte- and word-oriented polling areas are a little different. Therefore, a selection cannot be changed once made.

Standard Mode

## 5.15.1 Byte-Oriented Polling Area

The byte-oriented polling area is located on a byte address. The controller must be able to access this area in bit-mode!

| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| Byte Address +0 | Write Coordination Byte | | | | | | | |
| | Free | Free | Free | DDF | LM | PL | RQ | ED |
| Byte Address +1 | Serial Message Channel Low Byte | | | | | | | |
| Byte Address +2 | Serial Message Channel High Byte | | | | | | | |
| Byte Address +3 | LED1 On/Off | LED1 Flashing | LED2 On/Off | LED2 Flashing | LED3 On/Off | LED3 Flashing | LED4 On/Off | LED4 Flashing |
| Byte Address +4 | LED5 On/Off | LED5 Flashing | LED6 On/Off | LED6 Flashing | LED7 On/Off | LED7 Flashing | LED8 On/Off | LED8 Flashing |
| Byte Address +5 | LED9 On/Off | LED9 Flashing | LED10 On/Off | LED10 Flashing | LED11 On/Off | LED11 Flashing | LED12 On/Off | LED12 Flashing |
| Byte Address +6 | LED13 On/Off | LED13 Flashing | LED14 On/Off | LED14 Flashing | LED15 On/Off | LED15 Flashing | LED16 On/Off | LED16 Flashing |
| Byte Address +7 | LED17 On/Off | LED17 Flashing | LED18 On/Off | LED18 Flashing | LED19 On/Off | LED19 Flashing | LED20 On/Off | LED20 Flashing |
| Byte Address +8 | LED21 On/Off | LED21 Flashing | LED22 On/Off | LED22 Flashing | LED23 On/Off | LED23 Flashing | LED24 On/Off | LED24 Flashing |
| Byte Address +9 | LED25 On/Off | LED25 Flashing | LED26 On/Off | LED26 Flashing | LED27 On/Off | LED27 Flashing | LED28 On/Off | LED28 Flashing |
| Byte Address +10 | LED29 On/Off | LED29 Flashing | LED30 On/Off | LED30 Flashing | LED31 On/Off | LED31 Flashing | LED32 On/Off | LED32 Flashing |
| Byte Address +11 | LED33 On/Off | LED33 Flashing | LED34 On/Off | LED34 Flashing | LED35 On/Off | LED35 Flashing | LED36 On/Off | LED36 Flashing |
| Byte Address +12 | LED37 On/Off | LED37 Flashing | LED38 On/Off | LED38 Flashing | LED39 On/Off | LED39 Flashing | LED40 On/Off | LED40 Flashing |
| Byte Address +13 | LED41 On/Off | LED41 Flashing | LED42 On/Off | LED42 Flashing | LED43 On/Off | LED43 Flashing | LED44 On/Off | LED44 Flashing |
| Byte Address +14 | LED45 On/Off | LED45 Flashing | LED46 On/Off | LED46 Flashing | LED47 On/Off | LED47 Flashing | LED48 On/Off | LED48 Flashing |

Fig. 5-47: Byte-oriented polling area

Standard Mode

## 5.15.2 Word-Oriented Polling Area

The word-oriented polling area is located on a word address. The controller must be able to access this area in bit-mode!

| | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Word Address +0 | Write Coordination Byte | | | | | | | | | | | | | | | |
| | Free | Free | Free | DDF | LM | PL | RQ | ED | Free | Free | Free | Free | Free | Free | Free | Free |
| Word Address +1 | Serial Message Channel High Byte | | | | | | | | Serial Message Channel Low Byte | | | | | | | |
| Word Address +2 | LED1 On/Off | LED1 Flashing | LED2 On/Off | LED2 Flashing | LED3 On/Off | LED3 Flashing | LED4 On/Off | LED4 Flashing | LED5 On/Off | LED5 Flashing | LED6 On/Off | LED6 Flashing | LED7 On/Off | LED7 Flashing | LED8 On/Off | LED8 Flashing |
| Word Address +3 | LED9 On/Off | LED9 Flashing | LED10 On/Off | LED10 Flashing | LED11 On/Off | LED11 Flashing | LED12 On/Off | LED12 Flashing | LED13 On/Off | LED13 Flashing | LED14 On/Off | LED14 Flashing | LED15 On/Off | LED15 Flashing | LED16 On/Off | LED16 Flashing |
| Word Address +4 | LED17 On/Off | LED17 Flashing | LED18 On/Off | LED18 Flashing | LED19 On/Off | LED19 Flashing | LED20 On/Off | LED20 Flashing | LED21 On/Off | LED21 Flashing | LED22 On/Off | LED22 Flashing | LED23 On/Off | LED23 Flashing | LED24 On/Off | LED24 Flashing |
| Word Address +5 | LED25 On/Off | LED25 Flashing | LED26 On/Off | LED26 Flashing | LED27 On/Off | LED27 Flashing | LED28 On/Off | LED28 Flashing | LED29 On/Off | LED29 Flashing | LED30 On/Off | LED30 Flashing | LED31 On/Off | LED31 Flashing | LED32 On/Off | LED32 Flashing |
| Word Address +6 | LED33 On/Off | LED33 Flashing | LED34 On/Off | LED34 Flashing | LED35 On/Off | LED35 Flashing | LED36 On/Off | LED36 Flashing | LED37 On/Off | LED37 Flashing | LED38 On/Off | LED38 Flashing | LED39 On/Off | LED39 Flashing | LED40 On/Off | LED40 Flashing |
| Word Address +7 | LED41 On/Off | LED41 Flashing | LED42 On/Off | LED42 Flashing | LED43 On/Off | LED43 Flashing | LED44 On/Off | LED44 Flashing | LED45 On/Off | LED45 Flashing | LED46 On/Off | LED46 Flashing | LED47 On/Off | LED47 Flashing | LED48 On/Off | LED48 Flashing |

Fig. 5-48: Word-oriented polling area

## 5.15.3 Serial Message Channel

The serial message channel is a part of the cyclical polling area and is used to transfer 16-bit information. The numbers of serial messages, selection of message masks, external selection of masks and transfer of control codes are made possible via this data channel.

The following handshake is used for the information transfer:

The PLC stores a value (> 0) in this data word. This value is then transferred to the operating device which will write the value 0 into this data word again. This indicates to the PLC that it can now transfer the next

value. The value is interpreted by the operating terminal and its function is executed.

Values can be:

- Message numbers
- Mask numbers (mask number + 8000H)
- Control Codes

## 5.15.4 Image of the Status LEDs

The LED image enables the controller to control the status LEDs of the function keys of the connected operating device. The functions ON, OFF, or FLASHING can be set for each status LED. As soon as the controller sets a bit, the assigned LED on the operating device is influenced accordingly.

In this context, it is important that the length of the polling area and the polling time were also set correctly. If these additional parameters were not set correctly, problems may occur during the LED control.

For a function key that leads directly to the message mask, the status LED is influenced by the message system. In this way, the message system indicates that a new message has been received and has not yet been acknowledged. To influence the status LED of this function key from the controller, you must set the message priority to 0 (zero).

| Bit 1 | Bit 2 | Status of the LED |
|---|---|---|
| 0 | 0 | OFF |
| 0 | 1 | OFF, FLASHING is preset |
| 1 | 0 | ON |
| 1 | 1 | FLASHING |

Fig. 5-49: Truth table for a status LED

## 5.15.5 Polling Time

The polling time specifies the intervals the operating device will use to read the variable for the cyclical polling area. You set the polling time in the system parameters for the polling area. The polling of this variable also covers the Write Coordination byte, the serial message channel, and the image of the status LEDs.

Settings in or around a half a second have proven useful in most protocols. If the cycle time set is too low, the interface protocol can no longer follow requests, and reaction performance deteriorates.

There is no universal recipe, however.

The options available primarily depend on the individual project. However, at the very least, times greater than 100 ms should be preselected. For further information, please contact our support hotline.

### 5.15.6 Size of the Polling Area

Depending on the data type and operating device, the polling area has a length of up to 23 bytes. The entry allows adjustment to suit the area actually used, if you can avoid using the image of the status LED or part of this. The basic setting for all operating devices is a length of 12 bytes.

## 5.16 Control Codes

You can use hexadecimal control codes to control special functions on the operating device. The control codes are transferred to the operating device using the polling area. The operating device interprets the control code and subsequently triggers the corresponding function.

The following functions can be requested by the controller:

| Code | Function |
|---|---|
| 7FC7 | Delete data logger 1 |
| 7FC8 | Delete data logger 2 |
| 7FC9 | Delete data logger 3 |
| 7FCA | Delete data logger 4 |
| 7FCB | Trigger data logger 1 |
| 7FCC | Trigger data logger 2 |
| 7FCD | Trigger data logger 3 |
| 7FCE | Trigger data logger 4 |
| 7FCF | Write values of the running time meters to the controller |
| 7FEx | Switch to another language (x = language number) |
| 7FF2 | Automatic data release for scanner module |
| 7FF3 | Reload event-controlled variable values |
| 7FF4 | Transfer single data set from the controller |
| 7FF5 | Delete acknowledged messages from serial message memory |
| 7FF6 | Cancel printing the print log |
| 7FF7 | Printing a print log |
| 7FF8 | Printing a data set |

Fig. 5-50: Control Codes

| Code | Function |
|---|---|
| 7FF9 | Set clock in operating device |
| 7FFA | Data set transfer from controller to operating device (block mode) |
| 7FFB | Data set transfer from operating device to controller |
| 7FFC | Send keyboard image to controller |
| 7FFD | Data set transfer from controller to operating device (single mode) |
| 7FFE | Erase serial message memory |
| 7FFF | Refresh message system |

Fig. 5-50: Control Codes

Standard Mode

## 5.16.1 Delete Data Logger

You can use the following control codes from the controller, to have the operating device delete the data logger values.

**Hexadecimal code:**

**7FC7h** deletes data logger 1

**7FC8h** deletes data logger 2

**7FC9h** deletes data logger 3

**7FCAh** deletes data logger 4

## 5.16.2 Trigger Data Logger

You can use the following control codes from the controller, to have the operating device trigger a data logger to log a new value.

**Hexadecimal code:**

**7FCBh** triggers data logger 1

**7FCCh** triggers data logger 2

**7FCDh** triggers data logger 3

**7FCEh** triggers data logger 4

## 5.16.3 Write Values of Running Time Meters to Controller

You can use the following control code from the controller, to have the operating device pass the values of the running time meters to the controller.

Only the values of active running time meters are transferred.

**Hexadecimal code:** **7FCFh**

## 5.16.4 Switch to Another Language

You can use the following control code from the controller, to have the operating device switch to another language.

The number of the language is the least significant digit of the hexcode.

Valid hexadecimal values for the language number are **7FE0h** to **7FEFh**.

Valid decimal values for the language number in the Language Parameters dialog are 1 to 16.

**Hexadecimal code:** **7FExh**

Standard Mode

**Example 1:** You want to load the language with the number 4.

Write the hexadecimal number 7FE3 to the address of the serial message channel.

**Example 2:** You want to load the language with the number 12. Write the hexadecimal number 7FEB to the address of the serial message channel.

## 5.16.5 Automatic Data Release for Scanner Module

You can use the following control code from the controller, to have the operating device automatically read in the values from the connected scanner.

**Hexadecimal code:** **7FF2h**

## 5.16.6 Reload Event-Controlled Variable Values

You can use the following control code from the controller, to instruct the operating device to read all variable values from the controller again that are currently displayed in a mask and have the property Event-Controlled.

**Hexadecimal code:** **7FF3h**

## 5.16.7 Transfer Single Data Set from Operating Device to Controller

You can use the following control code from the controller, to have a single data set transferred from the operating device to the controller.

You must write the number of the data set to the variable defined for this purpose. In addition, you need to define the corresponding variables for the transfer buffers.

**Hexadecimal code:** **7FF4h**

## 5.16.8 Delete Acknowledged Messages from Serial Message Memory

You can use the following control code from the controller, to have all acknowledged messages of the operating device's serial message system erased.

In addition, the delete variable must contain the value **E216h**. This is to help avoid unintentional deletion. The delete variable is deleted in the system parameters for the serial message system.

**Hexadecimal code:** **7FF5h**

## 5.16.9 Cancel Printing the Print Log

You can use the following control code from the controller, to instruct the printer connected to the operating device to cancel the current print job for a print log.

**Hexadecimal code:** **7FF6h**

## 5.16.10 Printing a Print Log

You can use the following control code from the controller, to instruct the printer connected to the operating device to print the print log whose number was written to the variable defined for this purpose.

**Hexadecimal code:** **7FF7h**

The operating device will write one of the following four values back to the variable for the print log number to allow the print process to be monitored.

| Value | Description |
|---|---|
| 0 | Print log printed with no errors. |
| 1 | Printing of the data set with the desired data set number is not possible |
| 2 | The selected print log does not exist. |
| 3 | Print process stopped. |

Fig. 5-51: Return values from operating device

## 5.16.11 Printing a Data Set

You can use the following control code from the controller, to instruct the printer connected to the operating device to print the current data set.

**Hexadecimal code:** **7FF8h**

The operating device will write one of the following two hexcodes back to allow the print process to be monitored.

| Value | Description |
|---|---|
| 0x0h | Data set printout OK |
| 0XFF | Printing of the data set with the desired data set number is not possible |

Fig. 5-52: Return values from operating device

Standard Mode

## 5.16.12 Set Clock in Operating Device

You can use the following control code from the controller, to have the operating device set the real time clock in the device as specified in a defined control word.

For the clock, the year can be set as two digits only.

**Hexadecimal code:** **7FF9h**

See chapter “Date and Time Image“ on page 5-139.

## 5.16.13 Data Set Transfer from Controller to Operating Device (Block Mode)

You can use the following control code from the controller, to have a data set transferred from the controller to the operating device. The data are transferred in block mode.

The number of the data set must be written to the variable defined for this purpose.

In addition, the corresponding variables for the transfer buffers must be defined.

**Hexadecimal code:** **7FFAh**

## 5.16.14 Data Set Transfer from Operating Device to Controller

You can use the following control code from the controller, to have the operating device transfer a data set from the operating device to the controller.

The number of the data set must be written to the variable defined for this purpose.

In addition, the corresponding variables for the transfer buffers must be defined.

**Hexadecimal code:** **7FFBh**

Standard Mode

## 5.16.15 Send Keyboard Image to Controller

You can use the following control code from the controller, to have the current keyboard status transferred from the operating device to the controller.

**Hexadecimal code:** **7FFCh**

## 5.16.16 Data Set Transfer from Controller to Operating Device (Single Mode)

You can use the following control code from the controller, to have a data set transferred from the controller to the operating device. The data are read in single mode.

The number of the data set must be written to the variable defined for this purpose.

In addition, the corresponding variables for the transfer buffers must be defined.

**Hexadecimal code:** **7FFDh**

## 5.16.17 Erase Serial Message Memory

You can use the following control code from the controller, to have the entire message memory of the operating device's serial message system erased.

**Hexadecimal code:** **7FFEh**

## 5.16.18 Refresh Message System

You can use the following control code from the controller, to have the operating device load all new parallel messages.

This allows implementation of an event-controlled message system.

**Hexadecimal code:** **7FFFh**

## 5.17 Password Protection

Password protection prevents masks from being accessed and the data they contain from being altered without proper authorization. The protective function is available in every operating device. It is achieved by assigning access levels to masks and by using passwords.

Unless otherwise specified by the programmer, the access levels for all masks automatically default to the lowest level (=0). That means, no password is required to access masks with this access level.

Two authorization levels, referred to as the **edit level** and **view level**, are assigned to every password.

**View level**

**View level** means that the next mask can be viewed after the password is entered; but the values in it cannot be edited.

**Edit level**

**Edit level** means that the mask can be viewed after the password is entered and the values in it can be edited.

The following rules apply to passwords:

- Access is permitted if the view level and edit level values are greater than or equal to the values specified for the access level.
- The edit level must be equal or less than the view level.
- The higher the values for the view level and edit level, the higher the degree of authorization.
- The valid range of values for the view level and edit level is 0 to 255.
- The default setting for both is 0.
- The authorization levels are automatically set to 0 if you enter an incorrect password.
- If you select the Data Release key for an edit level that is too low, no function is implemented when you select the key.

You can enter a password in all masks. The only special case is the setup mask. The system variable **MskchgPasswd** is available for entry.

See chapter “MskChgPasswd“ on page 5-79.

In the programming software, you can select the Password Editor, which allows hidden password entry on the operating device. An X then appears for each character you enter in the operating device.

Standard Mode

**Master Password**

During programming, we advise you to ensure that at least one password, a master password, has the highest authorization level. The first password entered in the programming system is of particular significance as a master password. Unlike all other passwords, the master password cannot be changed in the operating device. It also allows you to reset all changed passwords to the standard values entered in the programming software.

**Example for using access levels:**

Access level for mask 5 = 10

Access level for mask 6 = 20

Access level for mask 7 = 30

Password 4712 has the edit level = 15 and the view level = 25

The following accesses are possible after the password **4712** has been entered:

- Mask 5 will be displayed, editing of values is authorized.
- Mask 6 will be displayed, editing of values is **not** authorized.
- Mask 7 will **not** be displayed, editing of values is **not** authorized.

**Start-up mask**

The access level for the start-up mask is always 0.

**Setup mask**

The setup mask is an exception with regards to the password and external data release functions. Since no communication is taking place when the setup mask is displayed, the external data release function is not applicable.

To restrict access, passwords must be used!

By defining the die system variable **MskchgPasswd** as the first editable variable in the setup mask, all further variables can be protected against unauthorized access. The view level does not apply when accessing the setup mask. Viewing is always permitted if a value less than or equal to 254 is selected for the access level of the setup mask.

The edit level for all variables of the setup mask, with the exception of the system variable **MskchgPasswd**, is the same as that defined as the access level.

Access to the mask is always denied if an access level of 255 is defined for the setup mask. This means that the setup mask will no longer be displayed during initialization of the operating device and can therefore not be selected. However, all device-specific parameters can also be edited in any other mask. The new parameters become effective by restarting the operating device or with the system variable **Boot**.

## 5.17.1 Password Management

In the password management function of the programming software, you can define up to eight different passwords, each with a length of 11

characters. When you are allocating the different passwords, think of how you want to structure access authorizations.

Example:

- Password for the manufacturer of the plant, machine, and so on
- Password for on-site service
- Password for the person setting up the machine, foreman, overseer
- Password for the operator of the system

The passwords are stored in the operating device's Flash memory. These passwords are the basic setting that is active when you first start up the system after each download. The passwords are also stored in the operating device's RAM.

You can reactivate the passwords stored in the Flash memory by writing to the system variable **FlashPasswd**.

See chapter “FlashPasswd“ on page 5-80.

You can change all passwords from the operating device, except for the master password (first password in the list). To do this, write the password to be changed to the system variable **MskchgPasswd**.

See chapter “MskChgPasswd“ on page 5-79.

You must then write the new password twice to the system variable **ChangePasswd**. The new password is valid immediately, provided you enter the same new password twice. If this is not the case, a corresponding system message is issued and the password is reset.

See chapter “ChangePasswd“ on page 5-80.

Passwords are stored and compared as 11-character strings. Use the alphanumeric editor to enter the passwords in the operating device.

Program passwords globally, and not on a language-specific basis.

## 5.17.2 Reactivate Password Protection

The access authorization for a mask or variable is reset when the following is carried out:

- The operating device is switched off and back on again.
- The wrong password is entered.
- A logical 1 is written to the PR bit of the Write coordination byte.
- The system variable **MskchgResPasswd** is activated.
- The option Reset Password is selected in the mask parameters of the password-protected mask.

## 5.17.3 Password Mask and Password Functions

You can create a password query mask. This mask will then appear when you try to go to a password-protected mask, and you have not already entered a password with sufficient authorization.

As soon as you enter a password with sufficient authorization in the password query mask, and select the Data Release key, the system opens the mask previously selected. No restrictions apply to the other content (for example, texts, other variables, and soft keys) in the mask.

For each mask of the user interface, you can specify whether password protection will be activated after you exit the mask.

If the operator has not entered a valid password, it must be possible to exit the mask. You can program the cursor key Home to do this, for example.

If you do not create a password query mask, the operator must enter a password in masks specifically provided for this purpose.

You can deactivate password protection entirely by writing the value 1 to the system variable **PasswdInactive**.

See chapter “PasswdInactive“ on page 5-81.

The operating device then behaves as if each mask were created with an edit and view level of 0. The system variable is battery-backed, that is, the deactivation still has an impact after you switch on the operating device again.

## 5.18 Real Time Clock in the Operating Device

Each operating device has a real time clock. You set the parameters of the real time clock in the system parameters. You use system variables to set the time, date, and weekday in the operating device, and insert

these variables in any mask.

You can transfer the data for the real time clock to the connected controller cyclically or on request, or provide values from the controller to the real time clock on request.

To allow the values to be exchanged, you must agree on a variable in which the image of date and time is stored. Enter the name of this variable in the system parameters of the real time clock either for setting the real-time clock or for transferring the real-time clock to the controller.

## 5.18.1 Date and Time Image

The time and date image describes the structure of the array variables that must be defined for setting and updating the time.

The date and time image is exchanged in the BCD format. For the image, you require an array variable with up to 8 bytes.

The length of the array variable is based on the length of the year specified. The following table illustrates the image with a 4-digit year:

| | | | |
|---|---|---|---|
| Address + 0 | H | H | Century (00 to 99) |
| Address + 1 | J | J | Year (00 to 99) |
| Address + 2 | M | M | Month (01 to 12) |
| Address + 3 | T | T | Day (01 to 31) |
| Address + 4 | h | h | Hour (00 to 23) |
| Address + 5 | m | m | Minute (00 to 59) |
| Address + 6 | s | s | Seconds (00 to 59) |
| Address + 7 | W | W | Weekday (0 to 6 or 1 to 7) |

Fig. 5-53: Image of date and time with a 4-digit year

| | | | |
|---|---|---|---|
| Address + 0 | J | J | Year (00 to 99) |
| Address + 1 | M | M | Month (01 to 12) |
| Address + 2 | T | T | Day (01 to 31) |
| Address + 3 | h | h | Hour (00 to 23) |
| Address + 4 | m | m | Minute (00 to 59) |
| Address + 5 | s | s | Seconds (00 to 59) |
| Address + 6 | W | W | Weekday (0 to 6 or 1 to 7) |

Fig. 5-54: Image of date and time with a 2-digit year

The byte for the weekday is independent of the calendar and always runs Modulo 6.

Create the names of the weekdays in a text list. To display the weekdays in the operating device, in any mask create the system variable **RTCDayofWeek** with the representation type **Selection Text**. Link this variable with the weekday text list.

You must order the names of the weekdays in the correct sequence. You can select any starting point.

| **Value** | **Text** |
|---|---|
| 0 | Saturday |
| 1 | Sunday |
| 2 | Monday |
| 3 | Tuesday |
| 4 | Wednesday |
| 5 | Thursday |
| 6 | Friday |

Fig. 5-55: Text list for operating devices with a Z80-CPU or RISC-CPU

## 5.18.2 Setting the Real Time Clock from the Controller

To update the real time clock data in the operating device from the controller, you must firstly create a variable in which the controller will store the date and time image. Enter this variable in the system parameters for the real time clock in the field **Setup**.

Finally, write the control code **7FF9h** in the serial message channel. This instructs the operating device to read the date and time image once from the agreed variable.

## 5.18.3 Transferring the Real-Time to the Controller

To transfer the real time clock data from the operating device to the controller, you must firstly create a variable in which the operating device will store the date and time image. Enter this variable in the system parameters for the real time clock in the field **Update**.

Then specify a polling time with which you want the operating device to write data at cyclical intervals into the variable.

Standard Mode

## 5.19 Help System

For each mask and each input variable in the project, you can create a help mask, and link these masks with each other. If you do not create or link any help masks, the default help mask is displayed.

The help texts are always limited to the size of one single mask.

### 5.19.1 Default Help Mask

The default help mask is always displayed if you have not linked any help mask to the mask or input variables. The default help mask is always available and only displays a blank page if it is not programmed.

### 5.19.2 Help Mask for Masks

You can create a separate help mask for each mask.

You can link the help mask with the mask using the mask parameters.

If the operator is in a mask and data release has not been requested, the help mask appears for this mask for the length of time you select the Help key, or after he has chosen a button that has been programmed accordingly.

In order for the button to simulate the key function of the Help key, you must create the Help key using the **key simulation** function, and link it with the system variable **KeyHelp**.

See chapter “KeyHelp“ on page 5-75.

### 5.19.3 Help Mask for Input Variable

You can create a separate help mask for each input variable.

You can link the help mask with the variable using the variable parameters.

If the operator is in a mask that contains a variable and data release has been requested, the cursor must be located at the variable. In this case, the help mask appears for the length of time he presses the Help key, or presses the button that has been programmed accordingly.

The help mask for an input variable is specifically designed for specifying the permitted range of values for the current input variable.

In order for the button to simulate the key function of the Help key, you must create the Help key using the **key simulation** function, and link it with the system variable **KeyHelp**.

See chapter “KeyHelp“ on page 5-75.

## 5.19.4 Help Mask for Message Masks

You can only create one help mask for a mask that contains a message field. You cannot call a help mask for any programmed input variables in the message mask.

If the operator is in a mask which contains a message field and data release has not been requested, the help mask appears for this mask for the length of time you select the Help key, or after he has chosen a button that has been programmed accordingly.

In order for the button to simulate the key function of the Help key, you must create the Help key using the **key simulation** function, and link it with the system variable **KeyHelp**.

See chapter “KeyHelp“ on page 5-75.

Standard Mode

## 5.20 Print Logs

A print log is made up of the printer page layout, static texts, and output variables. Print logs cannot contain graphic elements.

The print logs cannot be displayed on the operating device. Instead, they are only managed by the operating device and output using the interface SER2.

The logs do not necessarily have to be output to a printer. The data sent can also be read in by a higher-level system (host computer) and processed further to any degree.

A prefix and a postfix can be selected for each individual print log.

Prefixes and postfixes are control sequences that are transferred before and after the actual print log. The sequences are entered in a list within the system parameters for the print logs.

To ensure that print logs have a uniform layout, and to simplify the input of elements that are always the same, you can create sub-print logs, and link them with the print log.

You can use the following options to select default settings for the Print Log Editor.

- Font
- Grid/grid color
- Color of non-printable elements
- Color of output variables
- Zoom factor when opening the Log Editor

In the system parameters, you can select other settings for print logs.

- Page settings for the printer
- Symbolic name for the transfer variable of the log number
- Length of transfer variables
- Escape sequences for the printer

### 5.20.1 Escape Sequences for Print Logs

You can have one or several escape sequences sent to the printer before (prefix) and/or after (postfix) each print log. You can use these to:

- Generate a line feed
- Generate a page feed
- Change font
- Change font size
- Change font style

See the printer documentation for more information on the escape sequences you can define for your logging printer.

Enter the escape sequences with a unique name in a list. This list is then available for selecting the attributes for a print log.

## 5.21 System Parameters

The system parameters which you can specify in the programming software are stored in the operating device. You can set system parameters for the following areas:

- General parameters
- Polling area
- Terminal clock
- Running time meters
- Message system
- Variant options
- Password management
- Communication SER2
- Gateway
- Data set transfer
- Parallel outputs
- Touch screen and
- Print logs

### 5.21.1 General Parameters

Specify a time period in seconds for the polling time of the cyclical variables. Another data exchange process with the controller takes place after this time has elapsed.

Selecting the **Enable Automatic Download** check box will cause the operating device to automatically detect and activate downloading, without having to switch the corresponding user mode switch on the operating device. This function can only be used if a project with this setting has been loaded into the operating device using the standard procedure.

The same conditions apply to the **Enable automatic upload** check box.

Standard Mode

Select the **Deactivate password function if mask change is initiated by PLC** check box if

- The mask change is to be initiated by the controller.
- A currently active password protection for the controller is to be deactivated.
- You still want the operator to have to enter passwords to be able to access the same mask.

Select the **Enable mask change for active editor** check box if you want to allow the operator to change to another mask even when the data release is active.

The **Screen Saver** area allows you to determine if

A. no screen saver is to be used
B. the screen saver is to be activated for masks without cyclical variables only
C. the screen saver is to be activated for masks with cyclical output variables also

The turn-on time for the screen saver specifies the time interval allowed to elapse after the last action before the display of the operating device is blanked. The LED in the help key will flash during this time.

The screen saver is not available for use in all operating devices. Therefore, while options for selection will be available, a delay time cannot always be entered.

The **Input Variables** area allows you determine if

A. the input variable is to be displayed in inverse format while it is edited
B. pressing the Enter key lets you go to the next input variable

The **Table Editor** area allows you to determine if the cursor is to advance to the next row or the next column when you press the Enter key.

The **Symbolic addresses for...** area allows you to enter symbolic addresses for the image of the mask number, the image of the DIP switch (user mode switch), the Read coordination byte, the table index and the image of the keyboard.

Standard Mode

## 5.21.2 Polling Area

The polling area consists of three segments:

1. Read coordination byte (1 byte or 1 word)
2. Serial message channel (2 bytes or 1 word)
3. Segment for controlling the status LEDs in the function keys

You can

- operate the entire polling area with a single field variable OR
- operate each segment of the polling area with separate variables.

If you operate the polling area with 1 variable:

1. Specify the name of the variable for the polling area.
2. Specify the polling time.
3. Specify the size of the polling area.

If you operate the polling area with 3 variables:

1. Specify the name of the variable for the Read coordination byte.
2. Specify the name of the variable for the serial message channel.
3. Specify the name of the variable for controlling the status LED in the function keys

See chapter “Read Coordination Byte“ on page 5-119.
See chapter “Write Coordination Byte“ on page 5-121.
See chapter “The Cyclical Polling Area“ on page 5-124.
See chapter “Status LEDs of Function Keys“ on page 5-117.

## 5.21.3 Terminal Clock

Here you can specify the name of the variable used for the data associated with the date, the time and the day of the week in the controller as well as the polling time for data exchange.

Select the elements that are to be transferred. If no element is selected, no data transfer will take place. For the date, choose whether you want the year to be transmitted as a 2 or 4-digit value.

The terminal clock can be set from within the controller. For this purpose, a variable must be specified, where the time to be set is stored.

See chapter “Set Clock in Operating Device“ on page 5-133.
See chapter “Real Time Clock in the Operating Device“ on page 5-138.
See chapter “Date and Time Image“ on page 5-139.
See chapter “Setting the Real Time Clock from the Controller“ on page 5-140.
See chapter “Transferring the Real-Time to the Controller“ on page 5-140.

Standard Mode

## 5.21.4 Running Time Meters

Eight running time meters are available in the operating device.

For the control byte, enter the variable name which constitutes the address where the controller can influence the running time meters in the operating device.

If bit X is set in the control byte when polling is carried out, the running time meter X is incremented.

Using the address of the variable in the Reset Byte field, you can reset the running time meters in the operating device.

The polling time specifies the time intervals at which the operating device refreshes the running time meters.

The running time meters are activated in the operating device as soon as you have entered a variable name for the control byte and specified a value for the polling time. If the polling time is 0 or if there is no address for the control byte, the Running Time Meter function in the operating device is off.

You can specify an address in the controller for each running time meter. The operating device stores the value of the corresponding running time meter to this address when requested by the controller to do so. For this purpose, the controller needs to write the hexadecimal code **7FCFh** into the serial message channel of the polling area.

For each variable, you must provide a 32-bit memory area in the controller!

See chapter “Running Time Meter“ on page 5-117.
See chapter “Write Values of Running Time Meters to Controller“ on page 5-130.

## 5.21.5 Message System

You can specify general parameters and parameters for the serial and the parallel message system.

**General Parameters**

You can enter a message number to display a message directly. The message number also indicates its priority. The lowest message number has the highest priority and the highest message number has the lowest priority.

All messages that have a higher priority than the message number specified here are handled using a special procedure in the operating device when they appear. These messages are indicated by flashing of the status LED in the direct selection key of the message mask or are signaled by a system message.

Using the Size of Message Buffer, you define how many messages can be stored in the operating device. Specify the maximum number of messages to be managed by the operating device.

You can have the messages displayed in indented format. To do so, specify the number of characters by which the lines are to be indented after the first line. The value you enter here refers only to the display of messages in the operating device's message field.

The same options are available for outputting messages to the logging printer.

You can choose from four variants for outputting to the printer.

1. Print the entire message, SER2 reserved exclusively for message output
2. Formatted printout, SER2 reserved exclusively for message output
3. Print the complete message, SER2 reserved only temporarily for message output
4. Formatted printout, SER2 reserved only temporarily for message output

**Serial Message System**

From the controller, you can **erase all acknowledged messages** if you write the bit pattern **E216h** to the controller address **Delete Messages** and write the control code **7FF5h** to the serial message channel.

If you want to **delete all messages**, you need to write the control code **7FFEh** to the serial message channel. If you want to use this function of the operating device, you must assign a variable for deleting messages.

**Parallel Message System**

For the parallel message system, you must enter a Variable for Status Messages as the start address of the data area where the messages are stored in the controller in bit-coded form.

You can also specify a name for a Variable for Acknowledging Status Messages of the same size.

You also define the number of bytes to define the Size in Bytes of the area for the status messages in the controller.

You can define a maximum of 256 bytes for this area.

By entering the polling time, you also specify the interval at which the operating device reads the data area of the status messages from the controller.

For the polling time, you can enter values from 0 to 25.5 seconds.

The active messages are displayed in an I/O screen with a message field for parallel messages. The status messages can be sorted

according to various criteria.

See chapter “Delete Acknowledged Messages from Serial Message Memory“ on page 5-131.
See chapter “Erase Serial Message Memory“ on page 5-134.
See chapter “Serial Message System“ on page 5-171.
See chapter “Parallel Message System (Status Messages)“ on page 5-173.

## 5.21.6 Variant Options

Variant options are required if you want to

- implement a selection field to allow selection of variants in your project
- allow the number of fractional digits (precision) to be influenced depending on the variant used
- implement different user interface systems depending on the variant used

The variant selection can be configured in the Variant Buffer area.

Enter the name of the variable for the variant buffer. In addition, you need to specify the size of the buffer in bytes.

The maximum buffer size is 32 bytes.

The variant buffer is read only once during the initialization phase!

Using the variant buffer, you transfer a sequence of binary values to the operating device in order to enable or disable elements of a variant selection.

**Example for variant selection**

In the Fractional Digit Control area, enter the name of the variable that is used to define the number of places to follow the decimal point (fractional digits) globally. For variables, it is possible to specify the following for the formatting: fractional digits + offset or fractional digits – offset. The offset is entered into this variable.

If 2 fractional digits are specified for variable display and the variable for the fractional digit control contains the value '1', the following applies:

for + offset - 3 digits after the point are displayed (XXXX.xxx)

for - offset - 1 digit after the point (XXXX.x).

**Example for factional digit control**

In the Mask Reference List Control area, enter the name of the controller variable you want to use to specify the mask number.

## 5.21.7 Password Management

The password management function basically consists of an assignment of passwords to authorization levels.

See chapter “Password Protection“ on page 5-135.

## 5.21.8 Communication SER2

The operating device is equipped with a RS232 interface. This interface is used when the project is downloaded/uploaded during the programming phase. During normal operation, use the connection for a logging printer or a scanner.

Depending on the operating device, the interface is designed as a 9-pin or 25-pin DSUB plug-in connector.

The X3 / SER2 interface defaults to the following values when the programming system is started for the first time.

| **Parameter** | **Value** |
|---|---|
| Baud rate | 19200 Baud |
| Parity | Odd |
| Data bit | 7 |
| Stop Bits | 1 |
| Handshake | Software handshake |

Fig. 5-56: Default values for SER2

You can also configure the interface for a scanner.

### 5.21.8.1 Connecting a Scanner

You need to define a number of parameters before a scanner can be connected via the X3 / SER2 interface of the operating device.

These parameters initialize the scanner and define the specific data transfer information.

The parameters entered cannot be validated since you cannot select a specific scanner type.

You can connect any scanner with a RS232 interface that transmits ASCII characters.

In the **Scanner Parameters** area, you define a default and initialization parameter.

In the **Default** field, you enter an ASCII string that activates the scanner.

In the **Initialization** field, you enter an ASCII string that configures the scanner.

For more detailed information on initializing the scanner, please refer to the documentation provided by the scanner manufacturer.

For current information on how to use a scanner, refer to the online help of the programming software.

## 5.21.9 Gateway

Specifying gateway parameters is only relevant for operating devices that are equipped with the necessary firmware.

You can specify the following parameters for these devices:

- Smallest possible slave number
- Largest possible slave number
- Polling time for text list
- Cache size
- Polling time for cache
- Variable for cache address
- Variable for network status address.

## 5.21.10 Data Set Transfer

The variables for the data set transfer are required when you intend to use recipes in your project. These variables are used to handle the data set transfer from the operating device to the controller.

A data set is clearly identified in the operating device by a unique recipe number and data set number.

The first two variables are used when the operator wants to transfer a data set from the operating device to the controller. These variables allow the controller to identify the data set being transferred. The transfer is initiated by a bit in the **Read coordination byte**.

The two bottom variables allow the controller to request the transfer of a data set from the operating device. For this process, the controller writes the recipe number and the data set number of the respective data set to the two variables and signals the request via a bit in the **Write coordination byte**.

Standard Mode

## 5.21.11 Parallel Outputs

You can define a cyclical variable for the parallel outputs allowing you to control eight binary outputs via the operating device.

Specify the polling time for the repetition rate at which the variable is read from the controller.

Choose the outputs you want to influence.

The cyclical variable addresses a word (2 bytes) in the controller. Two bits of this word correspond to one output.

The following bit combinations apply:

| Bit 1 | Bit 2 | Status of the LED |
|---|---|---|
| 0 | 0 | OFF |
| 0 | 1 | OFF, FLASHING is preset |
| 1 | 0 | ON |
| 1 | 1 | FLASHING |

Fig. 5-57: Truth table for a parallel output

## 5.21.12 Touch Parameters

You can define the following default settings for touch-sensitive operating devices:

- Default sound
- Duration of the sound
- Default image for system icon.

**Default sound:** This is the default setting for the signal tone that sounds when the button is pressed.

The following options are available:

- No sound
- Sound when pressed
- Sound when released
- Sound when pressed and released
- Continuous sound while pressed.

**Duration of the sound:** Enter a time in seconds.

**Default image for system icon:** Enter the default image here that is needed when system icons are used.

## 5.21.13 Print Logs

The general print log parameters include the printer setup (page settings) and the variables defining the transfer of the print log number from the controller to the operating device.

For the printer Page Settings you can specify the Lines in Page and Characters in Line.

For detailed information on defining the page size, please refer to your printer manual.

A variable must be defined to be able to transfer the print log number from the controller to the operating device. If the controller transmits a command to print a print log, the operating device uses the log number currently stored in this variable.

To initialize the print log from the controller, the control code **7FF7h** must be written to the polling area.

The operating device writes the status of the print process to the same controller address.

The following statuses are transferred:

| Value | Status |
|---|---|
| 0 | Printing complete |
| 1 | Printer in use |
| 2 | Print log not found |
| 3 | Print log stopped |

Fig. 5-58: Parameters for print logs

## 5.22 Message System

The message system is an integral part of the user interface. Messages are reactions to events that are communicated to the operator in an intelligible form. A distinction is made between internally and externally generated messages, depending on where the event occurred. The diagram below shows the structure of the message system.

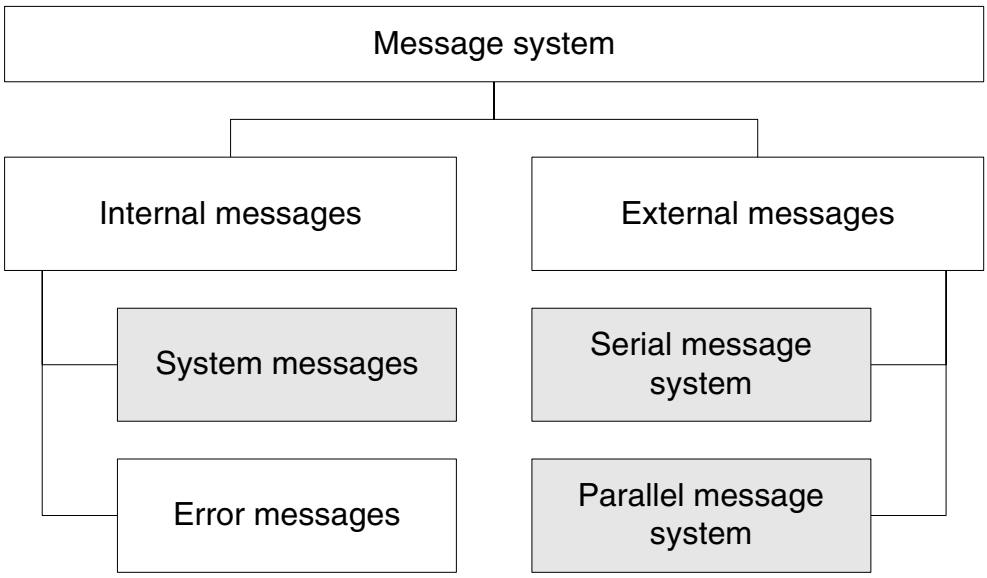


Fig. 5-59: Structure of the messages system

The areas shown in gray color can be freely designed during programming.

### 5.22.1 Internal Messages

Internal messages are all messages that are generated by the operating system. A distinction is made between system messages and error messages. The user (programmer) cannot influence the generation of these messages.

### 5.22.2 System Messages

System messages are generated by the operating system as a result of internal plausibility checks. A system message is activated immediately after the corresponding event has occurred.

Pending system messages are signaled to the operator

- by a flashing Help key status LED and
- setting the system variable **StateHelp** to the logical value '1'.

The message text of the system message is displayed if you

- press the Help key or
- press a corresponding button.

For key-operated devices, the system message is displayed for the length of time the key is pressed. For operating devices with a touch screen, you can configure an input/output mask specifically for displaying system messages. The button in which the system variable **StateHelp** is configured can at the same time be used to change to this mask.

If several system messages are pending at the same time, they will be displayed in the order of their system numbers. The system message number "1" represents the highest priority.

You can change the text of the system messages to suit you needs. The size of one screen is available for each system message text. The system message text can be freely designed using the terminal-specific fonts. Additional character attributes or graphics are not possible.

Icons are available for system message display on operating devices equipped with a touch screen. This allows system messages to be displayed graphically.

The texts are output in a language-specific manner, i.e. if the user interface is multilingual, the system messages are displayed in accordance with the selected language. The system message assignment is carried out by means of system message numbers. The system message number stands for a predefined event.

A brief description consisting of 20 characters is used to provide an explanation of the system number. The length of the texts is designed to allow them to be displayed on one line, even on the smallest operating device's display.

A newly created system contains the following system messages with brief descriptions:

| Number | Brief Descriptions |
|---|---|
| 1 | Wrong format |
| 2 | Value too large |
| 3 | Value too small |
| 4 | Replace battery |
| 5 | Message overflow |
| 6 | New message |
| 7 | Message buffer full |
| 8 | Invalid mask no |

Fig. 5-60: System Messages

| Number | Brief Descriptions |
|---|---|
| 9 | Invalid message no. |
| 10 | Print log invalid |
| 11 | Interface in use |
| 12 | Invalid password |
| 13 | Password unchanged |
| 14 | Overvoltage |
| 15 | Data set protected |
| 16 | Illegal data set |
| 17 | Data set unknown |
| 18 | Data set memory full |
| 19 | Data set active |
| 20 | Data set transfer |
| 21 | Password missing |
| 22 | Editing mode active |
| 23 | Data set file error |
| 24 | Data set format |
| 25 | Number invalid |
| 26 | Loop-through active |
| 27 | No data set address |
| 28 | Recipe unknown |
| 29 | Data set download |

Fig. 5-60: System Messages

### 5.22.2.1 System Message 1 - Wrong format

You are attempting to enter an invalid data format into a variable field of the numerical editor. For example, the number of places entered before the decimal point exceeds the setting specified in the user interface.

### 5.22.2.2 System Message 2 - Value too large

You are attempting to enter a value into a variable field of the editor that exceeds the variable's upper limit. The upper limit is defined in the user interface.

If you delete the system message text from the user interface, no system message will be issued, but the maximum permitted value will be entered instead.

### 5.22.2.3 System Message 3 - Value too small

You are attempting to enter a value into a variable field of the editor that is below the variable's lower limit. The lower limit is defined in the user interface.

If you delete the system message text from the user interface, no system message will be issued, but the minimum permitted value will be entered instead.

### 5.22.2.4 System Message 4 - Replace battery

A test performed on the battery indicated that its capacity has fallen below the limit value. This test is repeated every 60 minutes. To avoid loss of data when replacing the battery, the information in the respective operating device's user manual must be complied with.

The same message appears when you remove the battery, switching the device off at this point will, however, result in the battery-backed data being lost!

### 5.22.2.5 System Message 5 - Message overflow

Indicates that the system is unable to process the external messages quickly enough. Upon display of this message, one message has already been lost.

### 5.22.2.6 System Message 6 - New message

This text is displayed when the operating device has received a new external message whose priority exceeds the programmed threshold value and no direct selector key has been assigned to the message mask.

### 5.22.2.7 System Message 7 - Message buffer full

This text is displayed as a warning that the next external messages may overwrite the oldest or lowest-priority messages (depending on the configuration).

Standard Mode

### 5.22.2.8 System Message 8 - Invalid mask no

This text is displayed to indicate that a non-existing mask number has been transmitted by the controller via the serial message channel.

### 5.22.2.9 System Message 9 - Invalid message no.

This text is displayed to indicate that the controller has transmitted a message number that does not exist in the user interface.

### 5.22.2.10 System Message 10 - Print log invalid

The operator or the controller attempted to start a print log that does not exist in the user interface.

### 5.22.2.11 System Message 11 - Interface in use

Interface X3 is already being used by another print job. You are attempting to transmit different types of data to the printer at the same time (e.g. to print recipes and messages).

### 5.22.2.12 System Message 12 - Invalid Password

You entered a password which does not exist in the password management function. With this message, the previous access authorizations (view and edit level) are reset.

### 5.22.2.13 System Message 13 - Password unchanged

The operator did not enter the same new password twice in a row.

### 5.22.2.14 System Message 14 - Overvoltage

The operating device has detected that the supply voltage is too high. Switch the device off immediately to avoid damage. Check supply voltage.

### 5.22.2.15 System Message 15 - Data set protected

You attempted to modify individual values of a data set stored in the Flash or to delete the entire data set.

### 5.22.2.16 System Message 16 - Illegal data set

The data set number you specified as the destination for the data set copy process exists already or is outside the valid range (for example, Flash). The upload destination for a data set transfer is invalid (e. g. zero).

### 5.22.2.17 System Message 17 - Data set unknown

The data set with the number you selected does not exist in the data set list.

### 5.22.2.18 System Message 18 - Data set memory full

You attempted to create a new data set but the data set memory is full.

### 5.22.2.19 System message 19 - Data set active

You attempted to erase or to copy to the active data set, or to select a data set even though the active data set is currently being edited.

### 5.22.2.20 System Message 20 - Data set transfer

You attempted to initiate a data set transfer to the controller even though the previously initiated transfer has not yet been completed.

### 5.22.2.21 System Message 21 - Password missing

You attempted to switch to a password-protected mask or to edit a password-protected mask without having entered a password with sufficient authorization.

### 5.22.2.22 System Message 22 - Editing mode active

You attempted to change to another mask while the operating device was in editing mode.

### 5.22.2.23 System Message 23 - Data set file error

The data set file loaded from the PC to the operating device contains a syntax error. The error can be located by means of the line number system variable.

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### 5.22.2.24 System Message 24 - Data set format

The size or internal version identifier of a data set loaded from the PC to the operating device and the corresponding values in the programming software do not match.

### 5.22.2.25 System Message 25 - Number invalid

The bit pattern read from the controller is not valid for a floating point number. The number is output as 0,0.

### 5.22.2.26 System Message 26 - Loop-through active

The selected action was not performed due to an active loop-through operation.

### 5.22.2.27 System Message 27 - No data set address

The addresses for the data set transfer did not exist at the time of the controller's request.

### 5.22.2.28 System Message 28 - Recipe unknown

You attempted to select a recipe that does not exist in the operating device.

### 5.22.2.29 System Message 29 - Data set download

You initiated a data set transfer to the controller (download), but the Data Set Download Release bit in the Write coordination byte (bit 4) has not yet been set by the controller.

### 5.22.2.30 System Message 30 - Scanner error

Three different types of errors may have occurred:

1. A value was scanned, but the editor required was not open yet.
2. The scanner does not support this variable type.
3. The parameter settings for the scanner (prefix and postfix) are not correct.

### 5.22.2.31 System Message 31 - Print log unknown

You selected a print log that does not exist.

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### 5.22.2.32 System Message 32 - Error on changing the language

The language number you want to switch to, does not exist.

### 5.22.2.33 System Message 33 - Flash card information

The following errors may have occurred:

- Data error while downloading a project from the Compact Flash card.
- You inserted the Compact Flash card into the operating device.
- You removed the Compact Flash card from the operating device.

You can use the system variable **CFCardError** to display the type of error.

See chapter “CFCardError“ on page 5-102.

### 5.22.2.34 System Message 34 - New appl. necessary

The project in the operating device or the project in the controller has been modified and the operating device is trying to access variables that meanwhile have been modified.

## 5.22.3 Suppressing the Display of System Messages

You can prevent system messages from being displayed by deleting the corresponding text. The entry of the system message in the project management function remains existent.

**Example:**

System message 7 - "Message buffer full" is to be suppressed. Older messages or messages with a lower priority are to be overwritten.

Delete the system message text in the project management function.

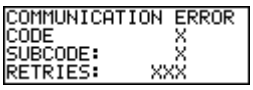
By suppressing the display of this system message, the user agrees that incoming messages automatically overwrite the oldest messages or those with the lowest priority once the message buffer is full.

## 5.22.4 Error messages

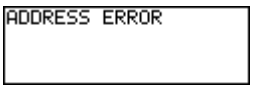
The messages listed here are displayed by the operating system in English. The size of the texts has been chosen in such a way that they can be displayed on every operating device.

The text output cannot be suppressed and the texts cannot be modified. The term "error message" is used because the terminal does not

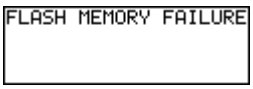
operate in accordance with the true meaning of the standard mode while these messages are displayed. In addition to true system errors, various conditions and processes are also described.



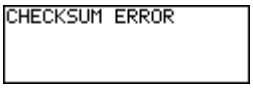

This message is generated for all types of protocol and interface errors. The error codes (CODE X) and SUBCODE (X) are protocol-specific and are listed in the respective description in the chapter on controller and bus connections. The connection with the communication partner has been interrupted. RETRIES displays the number of unsuccessful attempts to establish a connection. This number is incremented while the device is running. The number of retries depends on the protocol that is being used.



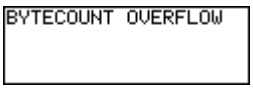

This message may be displayed during a download. The S3 file addresses physical addresses in the operating device. The transmission is aborted as soon as invalid addresses are detected during this process. The starting address of the invalid line in the S3 file is specified in hexadecimal format.



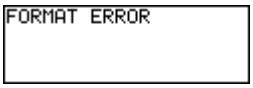

Is displayed during a download if the Flash Eprom cannot be programmed. This message indicates that the application memory is defective. The starting address of the invalid line in the S3 file is specified in hexadecimal format.




Error during transmission of the application description. The error has either occurred during the serial transmission or the S3 file contains invalid lines or no valid S3 file has been transmitted. Recompile the application description and attempt to retransmit.




Error during transmission of the application description. An error was detected in the S3 file of the application description. More bytes were received in one of the transmission lines than specified in the byte count.




Transmission format of the application description contains errors. The output file used has not been generated by this programming system. The transmitted file did not contain S0, S3 or S7 lines, no S3 format was used.

The user mode switch S4 was at the "on" position when the supply voltage for the operating device was switched on. The Flash data will be retained if the following instructions are complied with. Switch the device off, set S4 to "off" position, switch device on - data will be retained and the device will function as before. If S4 is set to the off-position while power is on - data will be lost, the device switches to the download mode!

The version of the programming system and the operating system in the operating device are not compatible. This error occurs if the wrong operating system version was selected for compilation of the application description. The two program versions must match.

The protocol driver loaded via the programming system and the operating device's operating system do not match. The two program versions

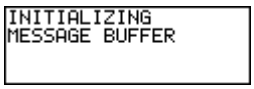
must match.

The parameters of the interface SER1 (X2) were modified. To achieve an operational connection, both communication partners must be set to the new parameters. This message is used for informational purposes if the connection to the communication partner cannot be established.

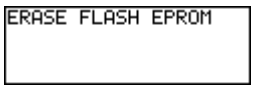
The operating system cannot find a protocol driver in the application description loaded. Select a protocol, recompile the application description and activate another download.

The protocol selected in the programming system when creating the application description and the operating device's hardware are not compatible. For example, the Interbus protocol driver has been loaded to a device with standard interfaces.

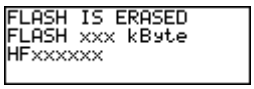
A self-test is performed and the keyboard is checked when the operating device is switched on. Make sure no keys are pressed during this process. Please follow the request. If this message is issued when no key is pressed, it indicates that the keyboard is defective!



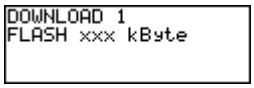

When the operating device is switched on, all messages in the operating device are sorted. This initialization process requires a certain length of time based on the number of stored messages. The message is always generated, but is only displayed for a very short time period or is not visible at all.



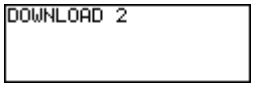

Is displayed while the mask memory is being erased. All of the programmed data are erased at this point.



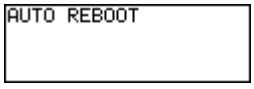

This message appears after the delete process is completed. Interface SER2 (X3) is initialized for download operating mode.




The operating device indicates that it is ready for a download with a baud rate of 19200 Bd via interface X3. A new project can now be loaded or new interface parameters for the transfer can be exchanged.




The operating device indicates that it is ready for a download with the new interface parameters. If no data are received within 20 s, the operating device will return to the DOWNLOAD 1 state.




The operating device will reboot after a few seconds.

The operating device reports its parameters during the startup process:

- CPU frequency in MHz
- Size of Flash memory in Kbytes
- Version number XXXXXXXX
- Loaded PLC driver YYYYYYYY

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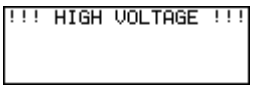
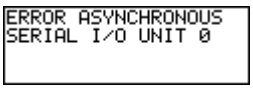
The Flash memory type used is being identified.




The voltage applied to the operating device is too high! This message will not disappear until the specified supply voltage has been reached.

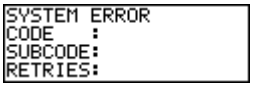



Initialization of the serial interface (unit 0 or unit 1) failed.

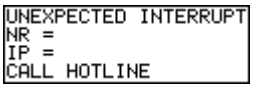
The program release of the SUCOnet K card and the current protocol driver are not compatible. Retrofit the operating device or use the appropriate driver version. The subcode specifies the level of the SUCOnet K card.

The program level of the keyboard card and the current firmware are not compatible. Retrofit the operating device. The subcode specifies the level of the keyboard card.

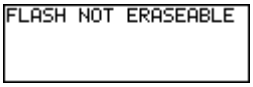
Indicates a successful update operation. The operating device reboots automatically.




A fatal error has been encountered. If this error message is displayed, contact your local Bosch Rexroth service. Before calling, make a note of the firmware and hardware version.

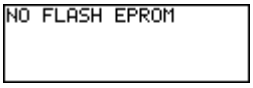



An unexpected interrupt has occurred. Contact your local Bosch Rexroth service. Before calling, make a note of the interrupt number (NR) and the program counter number (IP).

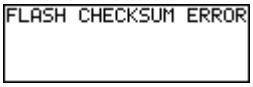



Is displayed after the device has been switched on or prior to a download to indicate that the Flash Eprom cannot be erased.

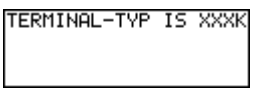
Is displayed at the beginning of a download to indicate that the S3 file is not the correct type for the operating device being used.



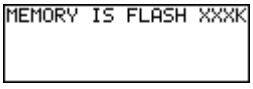

This message is displayed to indicate that no Flash supported by the programming algorithm can be detected.




The application description stored in the FLASH contains errors. This error may occur at the end of a transmission, e.g. if the transmission was incomplete or after a device, with a defective memory, is switched on.




An attempt has been made to load a S3 file which was intended for another device type. When this error occurs, the correct type for this operating device is displayed where "XXXX" appears. Recompile using this selection in the programming system.




An attempt has been made to load a S3 file which was created for a larger mask memory. The amount of memory space requested by the S3 file and the memory available in the terminal do not match. When

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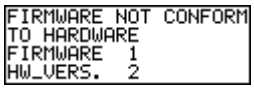
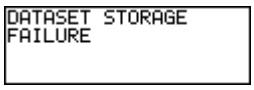
this error occurs, the memory size available in the device is specified, in Kbytes, where "XXX" appears. This value must be specified in the programming system when compiling.

An error message that should never occur, but which exists nevertheless. The terminal's operating system generates this error if proper operation is no longer possible due to a lack of plausibility. To be able to reproduce the incident, we need to know the code and subcode number as well as the software versions of the operating system and programming software. Do not hesitate to call our hotline and we will help you.




If this error message is displayed, contact your local Bosch Rexroth service. Before calling, make a note of the firmware and hardware version. The operating system of the operating device switches into an endless loop to prevent damage to the device.




A checksum error was detected when checking the memory areas of the recipe data sets. Either the battery or the RAM memory is defective.

## 5.22.5 External Messages

External messages are generated by the connected controller and forwarded to the operating terminal as information on the monitored process. The user can choose two separate message systems. Depending on the requirements, message transfers to the operating device can be either serial or parallel. This is regardless of whether the messages are process messages or fault messages.

Messages can consist of the message text and a scaled and formatted variable. Every variable type available in the system is valid.

The information in the message memory can be used for statistical evaluations. The message is assigned between the operating device and the controller by means of a message number. The associated texts and variable specifications are stored in the operating device together with the application description. The function of a message and its contents are determined by the user when the application description is created in the programming system.

All of the external messages are stored in the message memory in chronological order or in order of priority. You can optionally store parallel messages in the serial message memory to ensure that they are evaluated statistically as well. If the message contains a variable, its value will be frozen in the message memory.

### 5.22.5.1 Structure of an External Message

An external message is made up of the following:

- A message number from 1 to 9999

- Date
- Time
- Message text with up to 255 characters
- The values of up to two variables, from the time the message appears (only if available)

When a new project is being created, existing messages can be transferred individually or completely.

## Message Number

For external messages, the message number also determines the priority of the message. The message with the number 1 has the highest priority, and the message with the number 9999 has the lowest priority. You do not have to assign continuous message numbers.

The assignment of the message numbers in the area for status messages always starts with 1.

Make sure that the serial and parallel message systems do not overlap!

If you want both message systems to be independent of each other, make sure that the message numbers of the serial system start above the status messages.

f you would like to program full-page message outputs, you must harmonize the message and mask numbers.
See chapter “Full-Page Message Output“ on page 5-172.

From the system, you can also use status message texts in the serial message system.

## Message Text and Variable

The text length must not exceed 255 characters, including a formatted variable. The programming system will not allow you to enter texts longer than this.

The standard size of all characters of the operating device specified in each case is permitted. Each message text can contain two output variables.

The output format of the variables is identical to the one-off output variables in input/output masks. In this way, for example, coded texts can be used to modify individual messages or to use them for several statuses.

The output format of the message line can be changed online in a configuration mask for the message mask.

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The same options exist for serial and parallel messages.

**Example:** Complete message format:

| No. | Date | Time | Text 1 | Variable 1 | Text 2 | Variable 2 |
|---|---|---|---|---|---|---|
| **1234** | **25 Aug 92** | **11:30:00** | **Tempera-ture** | **285** | **°C at station** | **07** |

Explanation of the message structure:

| | |
|---|---|
| 1234 | 4-digit message number |
| 25 Aug 92 | Date - is recorded when the message is detected in the operating device |
| 11:30:00 | Time - is recorded when the message is detected in the operating device |
| Temperature | Text 1 in front of variable 1 |
| 285 | value of variable 1 at the time of message generation, is stored in the operating device |
| °C at station | Text 2 between variable 1 and 2 |
| 07 | value of variable 2 at the time of message generation, is stored in the operating device |

## 5.22.5.2 Size of Message Memory

The maximum message memory size allows management of up to 3000 message entries. As the amount of data is considerable, a high performance level is required when sorting the messages, and during resorting and initialization.

As you usually do not require this many entries, you can set the maximum memory size for messages as needed. The basic setting for the message memory allows 500 entries.

When making the setting, take note that for example, you will need about 50 pages of paper to print an entire message memory containing 3000 messages.

The message buffer is output in the message mask. You can use a system variable to define message sorting.

## 5.22.5.3 Message Sorting

You can optionally display messages in the message mask according to their time of arrival or according to their priority. The desired sorting option can be selected when the system is programmed.

If both possible message systems are used, it is possible to select the sorting settings separately. The settings are stored in the system variables **RepmanRepSortCrit** and **RepmanSortCritP**. You can use

these system variable to change the settings online on the operating device (using a configuration mask, for example).

If you do not give the operator a configuration option, the preselected sorting settings will apply.

Sorting options for the serial message system:

0 - by priority

1 - by time of arrival (most recent first)

2 - by time of arrival (oldest first)

3 - by group

Sorting options for the parallel message system:

0 - by priority

1 - by time of arrival (most recent first)

2 - by time of arrival (oldest first)

3 - by group

### 5.22.5.4 Message Priority for Direct Display

The priority of a message is determined by its message number.

The higher the message number, the lower the message priority.

The value that represents the upper limit for the message number that is to be indicated on arrival by a flashing LED or by outputting a system message can be entered into the system parameters of the message system.

If you enter the value 0, you will not be notified of newly arrived messages!

### 5.22.5.5 Printing the Message Memory

The memory contents of the serial and parallel message systems can be printed either in full or in part.

The entire content of the message memory of the **serial** message system is printed if the system variable **PrintAllRep** is set to the value '1' (formatted printout) or the value '2' (full-length printout).

The entire content of the message memory of the **parallel** message system is printed if you press a softkey or button linked to the system variable **PrintAllState**.

To print the message memory in part, the messages to be printed must be selected in the message mask. This is done by pressing the Data Release key in the message mask (or a corresponding button) and selecting the messages in the message field using the Cursor Up and Cursor Down keys.

The print job is started by pressing a soft key (or button) linked to the system variable **BlockPrint** (prints visible part of the selected block) or **BlockPrintLong** (prints messages of the selected block in full length). The system variables can additionally be included in a configuration mask and be edited online.

### 5.22.5.6 Direct Call of the Message Mask

In the programming software, you can link a function key or button with a message mask. You can use this function key (the button must be available in each mask) to go from each mask to the message mask. As well as accessing the message mask from a selection menu, you can then also use the function key to access the message mask. The integrated LED of the function key then takes on the task of indicating when new messages have been received. In this case, the LED flashes when a new message has been received.

When you select the flashing function key, the system goes directly to the message mask. When you select the function key again, the system automatically returns to the previous mask. The usual flashing help key LED is not available when programming a function key.

### 5.22.5.7 Message Output Formats

The following information is available for each external message:

- Message Number
- Date
- Time
- Message text
- The values of up to two variables, from the time the message appears (only if available)

You can use different system parameters to influence message display in a message mask or on a printer. You can set these parameters online in a programmed configuration mask.

System variables are then used to select and deselect message elements.

| Serial Messages | Parallel Messages | Affects |
|---|---|---|
| RepoutNr | RepoutNrP | Message Number |
| RepoutDate | RepoutDateP | Date |
| RepoutTime | RepoutTimeP | Time |
| RepoutAnzYear | RepoutAnzYearP | 2-digit or 4-digit display of the year |

Fig. 5-61: System variables for messages

You can select or deselect individual message elements to influence the length of a message line. These settings do not influence the information saved.

The following output variants are available for selection:

Complete message format:

| No. | Date | Time | Text 1 | Variable 1 | Text 2 | Variable 2 |
|---|---|---|---|---|---|---|
| 1234 | 25 Aug 92 | 11:30:00 | Temperature | 285 | °C at station | 07 |

Variants:

| | | | | | |
|---|---|---|---|---|---|
| 1234 | 25 Aug 92 | Temperature | 285 | °C at station | 07 |
| 1234 | 11:30:00 | Temperature | 285 | °C at station | 07 |
| 1234 | Temperature | 285 | °C at station | 07 | |
| 25 Aug 92 | 11:30:00 | Temperature | 285 | °C at station | 07 |
| 11:30:00 | Temperature | 285 | °C at station | 07 | |
| 25 Aug 92 | Temperature | 285 | °C at station | 07 | |
| Temperature | 285 | °C at station | 07 | | |

Standard Mode

## 5.22.5.8 Zooming Messages

Messages are displayed in a one-line format in the message mask for the sake of clarity. In order to display a longer message in its full length, the message must first be selected and then the Enter key pressed.

Line of the message mask on an operating device displaying 20 characters per line:

**1234 25 Aug 92 11:30:00 Station 137**

Zoomed view:

**1234 25 Aug 92 11:30:00**

**Station 137 in the furnace has a**

**temperature of 285 °C**

The zoomed view remains active for as long as you hold the Data Release key down. With smaller displays (for example, with 4 x 20 characters) only the message text is zoomed. The device type that is to be used must be considered when the text is programmed, to ensure the lines are wrapped correctly.

## 5.22.5.9 Acknowledging Messages

Message acknowledgment in the controller can be carried out by means of variables. Various editors or function keys (soft keys) are suitable for this purpose. The acknowledgment enables the controller to delete the message and initiate another verification.

## 5.22.6 Serial Message System

Two bytes are reserved in the cyclical polling area for the transfer of serial messages. These two bytes are referred to as the 'serial message channel'. The byte order depends on the selected data type of the polling area (see Polling Area). The controller writes a 16 bit message number in this message channel.

The operating device polls the entire polling area of the controller at cyclical intervals and transfers the serial message in the process.

Upon detecting a message (message number > 0), the operating device stores this message in the internal message memory and resets the serial message channel in the controller to zero (0). The value 0 indicates to the controller that the message has been picked up by the

operating device. The polling time for the serial message channel is configurable.

The same procedure is used to address external masks and message masks. Whenever the number transmitted corresponds to a mask number, this mask is displayed. If a mask and a message text exist for this number, the mask (message mask, full-page fault message text) is displayed and the associated message text is entered into the message memory.

Make sure that the message number is always written to the serial message channel with a 16 bit command!
As a result of asynchronous processing of some data transfer protocols, evaluation of the message number may lead to problems if the message number has been entered with single-byte commands.

### 5.22.6.1 Full-Page Message Output

The full-page message is a combination of message processing and external mask selection.

For full-page message mask output, a mask and a message text must be programmed with the same number.

The controller calls up the 'external mask' through the serial message channel. When it is called up, the mask is displayed and the associated message text is entered into the message memory. As you can choose the display content freely, it is possible to implement a message mask, full-page error output or other content types.

To be able to return to the previous mask from here, at least one mask parameter must be programmed with the function 'previous mask'. Message masks can also consist of several masks or even complete structures for troubleshooting. A separate, full-page help text can be configured for each full-page message.

### 5.22.6.2 Outputting Messages to a Logging Printer

When serial messages are logged directly, the printer always runs synchronously. Every new message arriving via the serial message channel is printed immediately and is transferred to the message memory in parallel. Here, attention must be paid that the printer can only process one print job at one time. Every print request must be ended before any further print request is started by the system.

You can influence message output to a printer with the system variable **RepmanRepPrint**.

The settings that apply when the formatted type of printout is selected are the same as those selected for the display of messages in the message mask.

The settings for the printout can be changed online on the operating device.

As the output consists of a pure text file, the message can also be read by a host computer or a PC. With a further system variable **PrintAllRepLong**, the full length of the message can be output.

### 5.22.6.3 Erasing the Message Memory Externally

The internal message memory of the serial message system can be erased externally, that is from the controller. To do this, a symbolic variable name for the delete variable must be specified in the Message System option of the system parameters in the programming software. Two bytes are needed in the controller for the variable.

The operating device always checks the delete variable in the controller once it has received the delete sequence (write the control code $\mathbf{7FFE}_H$ to the serial message channel). The internal message memory is erased when the delete variable contains the bit pattern $\mathbf{E216}_H$. The delete variable increases protection against unintentional deletion.

If deletion is not required, you should reset the variable or specify no symbolic name in the programming software.

## 5.22.7 Parallel Message System (Status Messages)

The parallel message system supplements the serial message system. The messages are transferred in parallel and evaluated in the operating device. In this context, the current message status is compared with the previous status in the operating device. The messages that no longer exist are automatically deleted from the memory, and new messages are added to the memory. The current status of the messages can be output.

All messages have a date and time, to enable you to determine when a message appeared for the first time.

The length of the message buffer cannot exceed 256 bytes.

Set the length in the system parameters for the message system in the programming software. Certain restrictions may apply to the length, depending on the protocol used.

Status messages are only retained in the message memory for the length of time they are reported by the controller. To set up a message system with acknowledgment, you must have the messages of the parallel message system written to the serial message memory. You must set the transfer of a message from the parallel to the serial message memory separately for each message.

Status messages can be transferred on a time- and/or event-controlled basis.

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## 5.22.7.1 Settings for Status Messages

### Size in Bytes

Enter the size of the parallel message system in bytes. You can transfer eight status messages per byte. The absolute size depends on the data type used (address of the variables). For example, the number of bytes is always rounded up for a word address.

The maximum size for the parallel message system is limited to 256 bytes.

Depending on the operating device, different storage quantities are available, which are also used differently for messages and data sets.

This is how you determine the memory requirement in your operating device:

| | **CPU in Operating Device** | |
|---|---|---|
| | **Z80** | **32 Bit RISC** |
| Available Memory Space in Bytes | About 116000 | About 116000 for FW version 1.07 or lower<br>About 147000 for FW version 1.08 or higher |
| Memory Requirement per Message (=1 Memory Location) | 24 Bytes | 32 Bytes |
| Memory Requirement per Data Set without User Data | 33 Bytes | 44 Bytes |

Fig. 5-62: Memory space / memory requirement

You must expect **three times the memory requirement** for the following message variants:

1. Messages containing 2 variables
2. Messages with 'Appear/Disappear'
3. Messages with acknowledgment ('Appear/Disappear' active).
4. Messages whose first variable has a size of greater than 4 bytes

The following table illustrates the memory use for 500 messages and a maximum number of data sets containing 22 bytes of user data:

| | **CPU in Operating Device** | |
|---|---|---|
| | **Z80** | **32 Bit RISC** |
| Available Memory Space in Bytes | About 116000 | About 116000 for FW version 1.07 or lower<br>About 147000 for FW version 1.08 or higher |
| Memory Requirement per Message in Bytes | 24 x 500 = 12000 | 32 x 500 = 16000 |
| Remaining Memory Capacity in Bytes | 104000 | About 100000 for FW version 1.07 or lower<br>About 12*4000 for FW version 1.08 or higher |
| Possible Number of Data Sets | 104000 / (22+33) = **1890** | 100000 / (22 + 44) = **1515** for FW version 1.07 or lower<br>1294000 / (22+44) = **1960** for FW version 1.08 or higher |

Fig. 5-63: Memory use for 500 messages

You can use the following formula to determine the exact message buffer size:

**G >= M1 + M3 + 20**

G = Size of message buffer

B = Size of parallel message system in bytes

M1 = Number of messages which: require only 1 memory location, are entered in the message editor and have message numbers smaller than B x 8

M3 = Number of messages which: require 3 memory locations, are entered in the message editor and have message numbers smaller than B x 8

20 = Minimum size of message buffer

## Polling Time

The polling time determines the intervals at which the variables for status messages are read again.

## Variables for Status Messages

You must specify the memory address for the parallel message system as a symbolic variable in the system parameters for messages . All variable types that the controller can access bit-by-bit, and the operating device can access byte-by-byte or word-by-word are permitted.

| **Word** | **High-Byte** | | | | | | | | **Low-Byte** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Byte** | **2** | | | | | | | | **1** | | | | | | | |
| **Bit** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| Message no. | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

Fig. 5-64: Structure of variables for status messages with 2 bytes

A bit set in a byte activates the corresponding status message in the operating device.

## Variable for Acknowledging Messages

The variable for acknowledging messages has the same structure as the variable for the messages themselves.

Each bit set in a byte represents the acknowledgment of the corresponding message.

# 5.23 Recipes

Various logically related variables can be organized into units known as recipes. Unlike mask variables, recipe variables are not transferred to the controller immediately after being entered, but are stored in the operating device as data sets. These data sets are protected against power failure. The data sets can be loaded to the controller as a unit as and when required.

The maximum number of recipes that can be created at programming time is 250. For each recipe, up to 250 data sets can be created. The data sets can either be created at programming time and be stored in the operating device's Flash memory together with the project or can be entered online on the operating device and are then stored in the battery-backed RAM.

You must copy data sets stored in the Flash memory to the RAM first before you can edit them. Data sets that have been edited remain in the battery-backed RAM.

Example for using recipes:Settings of a machine for manufacturing various products

| Variable | Value | Unit |
|---|---|---|
| Material | ST37-3 | |
| Feedrate | 25,00 | mm/s |
| Setpoint Value Axis 1 | 43,5 | mm |
| Setpoint Value Axis 2 | 56,30 | mm |
| Cutting Angle | 30 | ° |
| Cutting Speed | 110 | mm/s |

Fig. 5-65: Recipe for the product 'clamp'

| Variable | Value | Unit |
|---|---|---|
| Material | X20Cr13 | |
| Feedrate | 20,00 | mm/s |
| Setpoint Value Axis 1 | 45,6 | mm |
| Setpoint Value Axis 2 | 51,20 | mm |
| Cutting Angle | 45 | ° |
| Cutting Speed | 76 | mm/s |

Fig. 5-66: Recipe for the product 'shaft'

The variables Material, Feedrate, Setpoint Value Axis 1, Setpoint Value Axis 2, Cutting Angle and Cutting Speed can be organized into the recipe "Machine Settings for Products".

The variables Feedrate, Setpoint Value Axis 1 and Setpoint Value Axis 2 are defined as floating point numbers or fixed point numbers. The variable Cutting Angle is defined as an integer and the variable Material as a selection text (coded text).

The values for manufacturing the products Clamp and Shaft must be stored as data sets. Whenever another product is to be manufactured, the data set of the product to be manufactured next can be loaded into the controller.

The following check list contains all of the elements that are required and useful for creating and handling a recipe with data sets:

- The recipe itself (texts and variables)
- Data sets with data set number, data set name and variable offset
- I/O mask for the recipe
- Recipe field in the mask
- Recipe buffer (address for the data area in the controller)
- Variable Data Set Number for Transfer from operating device

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- Variable Recipe Number for Transfer from operating device
- Variable Data Set Number for Request from controller
- Variable Recipe Number for Request from controller
- System variables:

| **System Variable** | **Linked to** | **Description** |
|---|---|---|
| SelectDSNr | Selection Text/Decimal Number | Display/Select Data Set Number |
| SelectDSName | Selection Text Variable | Display/Select Data Set Names |
| DestDSNr | Positive Decimal Number | Destination Data Set Number for Copy Process |
| DSCopy | Softkey / Selection Text Variable | Activate 'Copy Data Set' |
| DSDelete | Softkey / Selection Text Variable | Delete Data Set |
| DSDownload | Softkey / Selection Text Variable | Load Data Set in Controller |
| DSDnload-Break | Softkey / Selection Text Variable | Stop Data Set Transfer |
| DSDnloadState | Selection Text Variable | Display Transfer Status |
| ActDSName | Alphanumeric Variable | Enter Name for RAM Data Set |
| Selec-tRezeptNr | Selection Text/Decimal Number | Display/Select Recipe Number |
| TabPgUp | Softkey | Page Up |
| TabPgDn | Softkey | Page Down |
| Break | Softkey | Cancel Input |
| LoadDSName | Selection Text Variable | Display Name of Last Data Set Transferred |
| StartSave | Softkey / Selection Text Variable | Data Set Transfer from Operating Device to PC |
| SaveState | Selection Text Variable | Display Transfer Status |
| StartRestore | Softkey / Selection Text Variable | Data Set Transfer from PC to Operating Device |
| RestoreState | Selection Text Variable | Display Transfer Status |
| RestoreLineNr | Positive Decimal Number | Display Current Transfer Line |
| StartRezPrint | Softkey / Selection Text Variable | Print Active Data Set |
| RezPrintState | Selection Text Variable | Display Printer Status |
| StartUpload | Softkey / Selection Text Variable | Data Set Transfer from Controller to Operating Device |
| UploadDSNr | Positive Decimal Number | Destination Data Set Number for Upload |
| UploadState | Selection Text Variable | Display Transfer Status |

Fig. 5-67: System variables for recipes

Standard Mode

## 5.23.1 Structure of a Recipe

A recipe comprises a maximum of 255 variables. In addition, up to 255 explanatory texts can be programmed. The variables and texts can be spread out over a maximum of 255 lines (with each line stretching across the entire width of the screen). A help text can be programmed for every variable.

The recipe is displayed in a recipe field, within an I/O mask, that extends over the entire width of the screen. The height of the recipe field can be as small as one line or as large as the entire height of the screen. The Cursor keys can be used to scroll through long recipes in the recipe field.

All one-line display formats can be used for recipe variables. Multiple-line formats can not be used (for example, multiple-line selection fields, tables, etc.). In addition, neither variables nor texts can be displayed with the zoom option.

## 5.23.2 Working with Recipes and Data Sets

The majority of the operations described below refer to the active data set. In order to activate a data set, first select the recipe to which it belongs and then the data set itself. How to select recipes and data sets is explained in the next two sections.

### 5.23.2.1 Selecting a Recipe

Each recipe is assigned a number from 1 to 250 when the recipes are programmed.

You can select a recipe as follows:

- By means of a fixed assignment between the recipe and a mask. This means, that whenever you open the corresponding mask, the recipe field will contain the recipe that was specified when programming was carried out. If you do not permanently assign a recipe to a mask with a recipe field during the programming phase, the last recipe that was processed appears when the mask is opened.
- By means of the system variable **SelectRezeptNr**. You can edit the system variable using any Editor. It is a good idea, however, to use a selection text (coded text) and assign meaningful recipe names to each recipe number.

See chapter “SelectRezeptNr“ on page 5-84.

### 5.23.2.2 Selecting a Data Set

Data sets can be assigned both a number from 1 to 250 and a name.

You assign the data set numbers and names when the data sets are created, in other words either when programming is carried out for the data sets stored in the Flash memory or on the operating device in the case of data sets stored in the RAM. The maximum data set name length is 15 characters. Data set names need not necessarily be unique (though it is recommended that they are).

You can select a data set as follows:

- Select a new recipe. The associated data set with the lowest number is then selected for the new recipe automatically.
- By means of the system variable **SelectDSNr**. You can edit this system variable only as a selection text. In this case, only the numbers of those data sets that are available for the active recipe are displayed.
- By means of the system variable **SelectDSName**. You can edit the system variable only as a selection text. In this case, only the names of those data sets that are available for the active recipe are displayed.

See chapter “SelectDSNr“ on page 5-82.
See chapter “SelectDSName“ on page 5-82.

### 5.23.2.3 Copying a Data Set

You can only copy the active data set. To do so, write the number of the destination data set to the system variable **DestDSNr** and then write the value 1 to the system variable **DSCopy**.

The following conditions must be fulfilled in order for the data set to be copied successfully:

- The number of the destination data set must be in the range of 1 to 250.
- There must not already be a data set with the same number for the active recipe (unless **DSCopy**is set to 3).
- The active data set cannot be edited at the same time.
- There must be enough free RAM on the operating device.

If any of these conditions is not satisfied, the data set is not copied and a system message is output.

The destination data set becomes the active data set after it has been copied.

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After it has been copied, the name of the destination data set consists merely of blanks. You can use the system variable **ActDSName** to change the name.

See chapter “DestDSNr“ on page 5-82.
See chapter “DSCopy“ on page 5-83.
See chapter “ActDSName“ on page 5-83.

### 5.23.2.4 Deleting a Data Set

You can only delete the active data set. To do so, you need to write the value 1 to the system variable **DSDelete**.

The following conditions must be fulfilled in order for the data set to be deleted successfully:

- The active data set cannot be edited at the same time.
- The data set must be stored in the RAM.

If any of these conditions is not satisfied, the data set is not deleted and a system message is output.

After the deletion, the data set with the lowest number in the current recipe becomes the active data set.

See chapter “DSDelete“ on page 5-83.

### 5.23.2.5 Modifying a Data Set

The active data set can be modified, providing it is stored in the RAM.

To change the contents of a data set, the variables must be edited in the recipe window. Note, however, that the new values are not written in the data set as soon as the Enter key is pressed, but are first stored in a temporary buffer.

The Data Release key must then be pressed in order to enter them into the data set. If the new data is not to be entered, the system variable **Break** can be set to 1 to discard the contents of the buffer. For ease of use, you might want to program one of the softkeys or a specific button to the system variable **Break**.

You cannot select another data set until the buffer contents has either been accepted or discarded.

If the controller changes to a different mask while a data set is being modified, or if the external data release is canceled again before you press the Data Release key, the buffer contents will likewise be discarded.

The modified data set is not transferred to the controller automatically. An explicit command from you or the controller is necessary first.

See chapter “Break“ on page 5-92.
See chapter “Transfer Single Data Set from Operating Device to Controller“ on page 5-131.

## 5.23.3 Data Set Transfer to/from Controller

You can load the data sets in the operating device to the controller. You can also load (any changed) data sets from the controller to the operating device. In this context, the data set transfer is always initiated by the operating device, but only when the controller has activated the corresponding release (Data Set Download Release bit in the Write Coordination byte).

Standard Mode

## 5.23.3.1 Transfer to the Controller (Operator-Controlled)

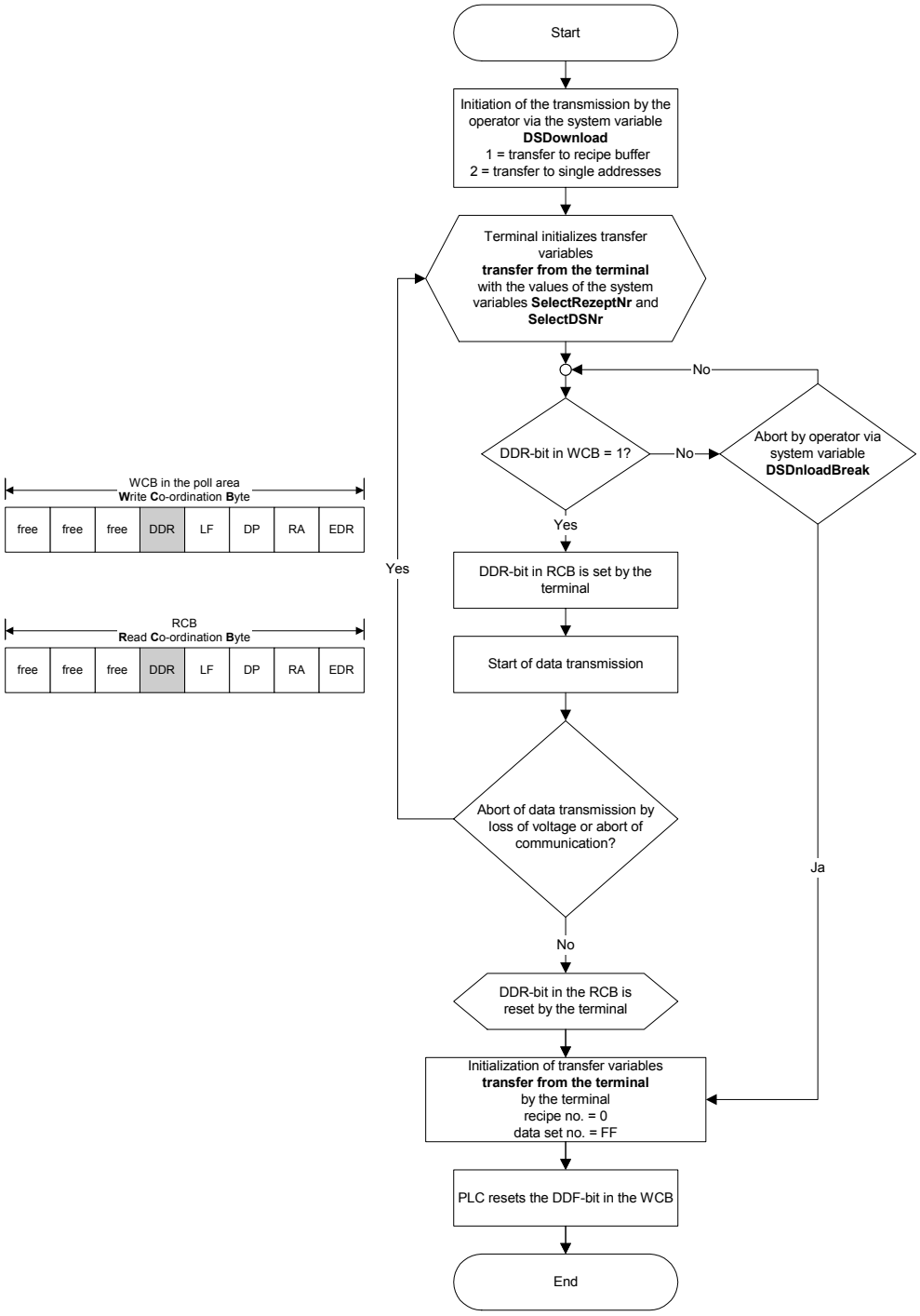

Start
Initiation of the transmission by the operator via the system variable **DSDownload**
1 = transfer to recipe buffer
2 = transfer to single addresses
Terminal initializes transfer variables **transfer from the terminal** with the values of the system variables **SelectRezeptNr** and **SelectDSNr**
No
DDR-bit in WCB = 1?
No
Abort by operator via system variable **DSDnloadBreak**
Yes
DDR-bit in RCB is set by the terminal
Start of data transmission
Abort of data transmission by loss of voltage or abort of communication?
Yes
Ja
No
DDR-bit in the RCB is reset by the terminal
Initialization of transfer variables **transfer from the terminal** by the terminal
recipe no. = 0
data set no. = FF
PLC resets the DDF-bit in the WCB
End
WCB in the poll area
**W**rite **C**o-ordination **B**yte
free free free DDR LF DP RA EDR
RCB
**R**ead **C**o-ordination **B**yte
free free free DDR LF DP RA EDR

Fig. 5-68: Data transfer to the controller (operator-controlled)

Standard Mode

## 5.23.3.2 Transfer to the Operating Device (Operator-Controlled)

Start
Upload to ...?
new data set
existing data set
Recipe buffer
Upload from .. ?
PLC single address
Recipe buffer
Upload from .. ?
PLC single address
Initialization of the system variable **StartUpload** with the value 4 by the operator
Initialization of the system variable **StartUpload** with the value 3 by the operator
Input of the destination data set number via the system variable **UploadDSNr**
Input of the destination data set number via the system variable **UploadDSNr**
Initialization of the system variable **StartUpload** with the value 2 by the operator
Initialization of the system variable **StartUpload** with the value 1 by the operator
Not enough memory?
Yes
Yes
Not enough memory or data set is protected?
No
No
Data transmission to the next free data set within the terminal memory
Indication of the error message via the status-LED "Help"
Data transmission to the data set which is defined in the system variable **UploadDSNr**
End

Fig. 5-69: Data transfer to the operating device (operator-controlled)

## 5.23.3.3 Transferring Data Sets to / from a PC

It is possible to transfer data sets to or from a PC via the interface X3, in order to back up the data sets that have been stored in the operating device, process the data or supply the operating device with new data sets.

It is also particularly important to back up the data sets if a new application description is loaded in the operating device, as all the data sets in the RAM are then deleted. If the recipe structure remains unchanged,

however, they can be reloaded into the operating device again after the application description has been loaded. If changes have been made to the structure of any of the recipes (number of variables, position of the variables in the data set buffer, etc.), only the data sets of the other, unchanged recipes can be reloaded into the operating device .

The data sets are transferred in a format that can be edited using a Text Editor (see section 3.8.4.3 Structure of the Data Set File).

The parameters for the X3 interface can be freely configured by means of the corresponding system variables. Merely make sure that the same parameters are set at the PC end. You can send or receive at the PC end with any suitable program, such as Windows Terminal (1).

### 5.23.3.4 Transfer to a PC

The transfer of data sets to the PC is initiated by writing a value to the system variable StartSave. The number of data sets that are transferred depends on the value that is written to the system variable. The following are valid values:

System variable value = 1: Only the active data set is transferred.

System variable value = 2: All of the data sets of the active recipe are transferred.

System variable value = 3: All of the data sets of all recipes are transferred.

The process can be monitored by the operator with the aid of the system variable SaveState.

### 5.23.3.5 Transfer from a PC

The operating device is placed to the Ready-to-Receive state when the system variable StartRestore is set to 1. The data sets can then be sent by the PC. The operating device recognizes the end of the data set transfer automatically by analyzing the data it has received. It then returns to its normal state.

To cancel the Ready-to-Receive state again without receiving data, the value of the system variable StartRestore must be changed to 2.

The system variable RestoreState indicates whether or not the terminal is ready to receive.

If a formatting error is detected in the received data, a system message to this effect is output and the receive process is terminated. The position of the formatting error can be located, at least approximately, with the aid of the system variable RestoreLineNr. This system variable contains the number of the last line to have been received.

Data sets can only be stored in the operating device if their structure is still identical to the data set structure specified for the corresponding recipe in the application description. This can be checked by the operating device on the basis of a version number (see Structure of Data Set File). If a data set which is found to be invalid is received, it is rejected and a system message to this effect is output. The receive process is not terminated, however.

If a data set with the same number as the transferred data set is already stored in the Flash Eprom, the newly received data set is rejected without any warning to the operator.

If a data set with the same number as the transferred data set is already stored in the RAM, a parameter setting in the received data (see Structure of Data Set File) determines whether or not the existing data set is overwritten. If it is not supposed to be overwritten, and another data set with the same number already exists in the operating device, the newly received data set is similarly rejected without any warning to the operator.

## 5.23.3.6 Structure of a Data Set File

The data sets transferred to the PC are generally stored in a file.

If this file is only used for backup purposes, the operator does not necessarily be familiar with its structure. In this case, the file can merely be transferred back to the operating device unchanged when it is needed.

If the data are to be processed further, for example, within the scope of production data acquisition, the user should understand the structure of the file.

All of the data in the data set file are represented by a simple language specifically developed for this purpose.

The following are elements of this language:

**Key words:** S + two further letters. They normally appear at the beginning of a line. Example: SDW or SFA

**Decimal number:** Any number of the digits 0-9, preceded by a negative sign when required. Example: 999 or -1234567

**Hexadecimal number:** H + any number of the digits 0-9 or letters A-F or a-f. Example: H999 or H123abCD4

**Hexadecimal string:** C + any even number of the digits 0-9 or letters A-F or a-f.

Example: C12 or CAAFF33

**ASCII string:** Any string of characters enclosed between two backslash characters (\) .

Example: \This is one ASCII string\

**Comment:**

Any string of characters enclosed between two dollar signs ($). Comments can be inserted in the data set backup file at any position and can stretch across several lines.

Example: $This is a comment$

Any number of separators (blanks, tab characters or line feed characters) can be placed between these language elements.

The above-mentioned language elements are used to create a file with the following structure:

- Start of file identifier
- Any number of data sets
- End of file identifier

A data set consists of:

- Data set header
- Any number of data set variables
- End of data set identifier

| **Start of File Identifier** | |
|---|---|
| Key | SFA |
| Parameter | none (date and time are output by the operating device as a comment) |

Fig. 5-70: Start of file identifier

| **End of File Identifier** | |
|---|---|
| Key | SFE |
| Parameter | none |

Fig. 5-71: End of file identifier

| **Data Set Header** | |
|---|---|
| Key | SDK |
| Parameter | Recipe number, data set number, data set name (as an ASCII string), data set size in bytes, recipe version number, write-over identifier |

Fig. 5-72: Data set header

| **Data Set Variables** | |
|---|---|
| Key | SDW |
| Parameter | Offset of the variables in the recipe, variable size in bytes, value of the variables (as a hexadecimal string) |

Fig. 5-73: Data set variables

| **End of Data Set Identifier** | |
|---|---|
| Key | SDE |
| Parameter | none |

Fig. 5-74: End of data set identifier

Explanations:

**Recipe version number** On creating or changing the recipe description in the programming software, this version number is increased automatically whenever the structure of the data sets has changed. To be able to load a data set from the PC to the operating device, the downloaded version number and the version number stored in the operating device for the recipe involved must match. The downloaded data set will not be stored if the version numbers do not match.

**Write-over identifier:** The value 1 means that the downloaded data set is to overwrite any data set with the same number that may already exist in the operating device. The value 0 means that the downloaded set is to be rejected if a data set with the same number already exists. Only those data sets can be overwritten that are not stored in the Flash memory, i.e. that were loaded into the operating device together with the project.

## 5.23.3.7 Printing Data Sets

The data set printout can be started from both the operating device and the controller.To be able to initiate a printout from the operating device, either the system variable **StartRezPrint** must be placed into a mask or a soft key must be assigned accordingly. The active data set can be printed via interface SER1 by writing the value 1 to the system variable. Writing the value 2 to the same system variable will cancel the print process. A heading including the recipe number, data set number and data set name will be printed at the beginning of each data set. The status of the print process can be displayed through the system variable RezPrintState. To be able to control a print job from the controller, the data set number and recipe number must be entered into the appropriate variables first. The print job is then started by writing the value **7FF8H** to the address of the serial message channel.

A value of 0 (zero) in the variable for the recipe number (for request from the operating device) will indicate that the data set is being printed.

If another print job is currently being printed so that the printer can not print the specified data set, the value 255 will be written to the variable for the recipe number (for request from the operating device).

Standard Mode

### 5.23.3.8 Memory Requirement for Data Sets

The RAM in the operating device that is not required by the system (approximately 110000 bytes) is used to store messages as well as data sets that have been stored in the RAM.

The size of the message buffer is configurable. Each message takes up 24 bytes. This makes a total of 12000 bytes for the default message buffer size (500 messages), so that a further 98000 bytes are available for storing data sets.

Space is also needed to store the data set name and management information (additional 28 bytes per data set).

Example:

If the data set size is programmed as 22 bytes, a total of

98000 / (22 + 28) = 1960

data sets can be saved in the RAM (message buffer size: 500). Other, fixed programmed data sets can also be stored in the Flash Eprom.

## 5.24 Memory Requirement for Messages and Data Sets

Depending on the operating device, different storage quantities are available, which are also used differently for messages and data sets.

| | **Z80-CPU** | **32 Bit RISC CPU** |
|---|---|---|
| Available Memory Space in Bytes | About 116000 | About 116000 for FW version 1.07 or lower<br>About 147000 for FW version 1.08 or higher |
| Memory Requirement per Message (=1 Memory Location) | 24 Bytes | 32 Bytes |
| Memory Requirement per Data Set without User Data | 33 Bytes | 44 Bytes |

Fig. 5-75: Memories in operating devices in comparison

You must expect three times the memory requirement for the following message variants:

1. Messages containing 2 variables
2. Messages with 'Appear/Disappear'
3. Messages with acknowledgment ('Appear/Disappear' active).
4. Messages whose first variable has a size of greater than 4 bytes

The following table illustrates the memory use for 500 messages and a maximum number of data sets containing 22 bytes of user data:

| | **Z80-CPU** | **32 Bit RISC CPU** |
|---|---|---|
| Available Memory Space in Bytes | About 116000 | About 116000 for FW version 1.07 or lower<br>About 147000 for FW version 1.08 or higher |
| Memory Requirement for Message in Bytes | 24 x 500 = 1200 | 32 x 500 = 16000 |
| Remaining Memory Capacity in Bytes | 104000 | About 100000 for FW version 1.07 or lower<br>About 1294000 for FW version 1.08 or higher |
| Possible Number of Data Sets | 104000 / (22+33) = 1890 | 100000 / (22+44) = 1515 for FW version 1.07 or lower<br>1294000 / (22+44) = 1960 for FW version 1.08 or higher |

Fig. 5-76: Memory use for 500 messages in comparison

You can use the following formula to determine the exact message buffer size:

G >= M1 + M3 + 20

G = Size of message buffer

B = Size of parallel message system in bytes

M1 = Number of messages which: require only 1 memory location, are entered in the message editor and have message numbers smaller than B x 8

M3 = Number of messages which: require 3 memory locations, are entered in the message editor and have message numbers smaller than B x 8

20 = Minimum size of message buffer

## 5.25 Application ID

You can use the application ID to identify any application.

The application ID is stored in the project's S3 file and is therefore stored in the operating device after the download. The same ID is stored in the project management file.

You can compare the IDs of a project management file with that of an S3 file.

You can also compare the IDs of an S3 file and operating device content. To do this, you must establish a connection between the PC and the operating device (download cable).

Standard Mode

The application ID is made up of the following elements:

- ID text
- Version
- Date
- Time
- Counter
- Postfix

**ID Text** The ID text has up to 13 characters. This means that the file name of the project can be entered in 8.3 format. You can edit the ID text as required.

**Version** The version of the programming software has up to 5 characters. This text cannot be changed.

**Date** The creation date has six characters. This text cannot be changed.

**Time** The time of the translation of the project is provided using six characters. This text cannot be changed.

**Counter** The counter has four characters and specifies the number of translation runs. This text cannot be changed.

**Postfix** The postfix is a random number made up of two characters. This number cannot be changed.

## 5.26 Version Number

You can use the version number to store any value in the operating device.

The valid range of values is 0 to 255.

The value is saved in the system variable **UserVersion**.

You can output this system variable in any input/output mask.

There is no other functional link in the operating device. You cannot change the value in the operating device.

See chapter “UserVersion“ on page 5-44.

## 5.27 Image of Mask Number

You can have the number of the current mask of the operating device written to a controller variable. The controller variable must be a 16-bit variable.

For each mask change, the operating device writes the current mask number in this variable. The mask number represents a mask-specific code.

This means that you can access the user interface from the controller.

## 5.28 Image of User Mode Switch

In standard mode, the image of the user mode switch is transferred to the controller after the initialization phase is complete. You can choose to have any unassigned DIP-switches evaluated by the controller. This allows you to call up specific programs or to create queries in a service routine.

## 5.29 Screen Saver

Some operating devices are fitted with a screen saver. This function monitors all outputs to the display. If the system detects that nothing is being output to the display, a timeout begins to elapse. After the timeout has elapsed, the display is blanked and the status LED in the Help key begins to flash. The display can be reactivated by pressing any key. Activation of the screen saver can be made dependent on the display of cyclical variables.

The monitoring time can be defined in 0.1 second steps. If you enter the value 0 for the time, the screen saver remains deactivated.

## 5.30 Documentation

You can document the entire content of a project in an RTF file. To determine the scope of documentation, select the required project elements that are arranged in a tree structure.

You can fine-tune the documentation layout by selecting and deselecting different documentation parameters.

### 5.30.1 Documentation Parameters

You can use the documentation parameters to influence the layout of the documentation to be generated for the selected elements of a project.

#### 5.30.1.1 Global Settings

Select whether you would like the mask reference lists in the document to be specified by name, or whether the current mask will be specified for a predefined variable value.

Standard Mode

If you only specify the mask reference list by name, a reference to the list appears in the documentation. The content of the list is not output.

You can also specify the current mask to which the system will go if the variable value comes up that you enter in the field beside the corresponding selection button.

A page feed can be inserted after each documentation element to improve presentation.

### 5.30.1.2 Projects

You can select whether the documentation will take account of all elements entered in the general project information.

### 5.30.1.3 Masks

You can have the position of variables created in a mask documented either in pixels or grid units. The grid unit is based on the font NORMAL.

If necessary, you can display the variables of a mask with sequential numbers. The system then specifies the variable's sequential number in the left position of the variable frame.

You can also activate the description of a mask’s variable.

Variables for which you have not specified a documentation value are displayed as an empty frame, if necessary.

For variables of the type Selection Text, you can output the entries of the linked text list, if necessary.

The number specified for the maximum number of text list entries must exceed the actual number of text list entries, to ensure that the texts are listed. This will ensure the selective documentation of all text lists in a mask that are under a specific number of entries.

If necessary, you can have documentation written for the functions of the function keys in a mask.

### 5.30.1.4 Recipes

You can have the position of recipe elements documented either in pixels or grid units. The grid unit is based on the font NORMAL.

If necessary, you can display the variables of a recipe with sequential numbers. The system then specifies the variable's sequential number in the left position of the variable frame.

You can also activate the description of a recipe's variable.

For variables of the type Selection Text, you can output the entries of the linked text list, if necessary.

The number specified for the maximum number of text list entries must exceed the actual number of text list entries, to ensure that the texts are listed. This will ensure the selective documentation of all text lists in a recipe that are under a specific number of entries.

In addition, you can specify whether the values of the recipe data sets are to be documented as well.

### 5.30.1.5 Help Masks

You can have the position of variables created in a help mask documented either in pixels or grid units. The grid unit is based on the font NORMAL.

If necessary, you can display the variables of a help mask with sequential numbers. The system then specifies the variable's sequential number in the left position of the variable frame.

You can also activate the description of a help mask's variable.

For variables of the type Selection Text, you can output the entries of the linked text list, if necessary.

The number specified for the maximum number of text list entries must exceed the actual number of text list entries, to ensure that the texts are listed. This will ensure the selective documentation of all text lists in a help mask that are under a specific number of entries.

### 5.30.1.6 System Messages

You can have the position of variables created in a system message documented either in pixels or grid units. The grid unit is based on the font NORMAL.

You can also activate the description of a system message's variable.

For variables of the type Selection Text, you can output the entries of the linked text list, if necessary.

The number specified for the maximum number of text list entries must exceed the actual number of text list entries, to ensure that the texts are listed. This will ensure the selective documentation of all text lists in a help mask that are under a specific number of entries.

Standard Mode

## 5.30.1.7 Messages

You can have the position of variables created in a message documented either in pixels or grid units. The grid unit is based on the font NORMAL.

You can also activate the description of a message's variable.

For variables of the type Selection Text, you can output the entries of the linked text list, if necessary.

The number specified for the maximum number of text list entries must exceed the actual number of text list entries, to ensure that the texts are listed. This will ensure the selective documentation of all text lists in a message that are under a specific number of entries.

## 5.31 Downloading a Project

The Download function describes how you can load a new project into the Flash memory of the operating device. To do this, you must connect the operating device with the PC and set it to the download operating mode.

To do this:

- In a mask, enter the value 1 in the system variable **IntEraseEprom** OR
- Switch off the supply voltage, set the user mode switch S4 to ON, switch on the device again, and - after the system message appears - switch the user mode switch S4 to OFF again under operating voltage.

If, instead of a Flash memory, the operating device contains a UV-erasable EPROM, the system recognizes this and prevents a deletion or programming process.

The following error message is displayed:

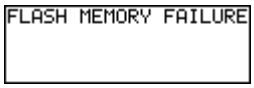



Fig. 5-77: Error message FLASH MEMORY FAILURE

This error message indicates that a write process was not completed successfully.

During programming, we recommend that you activate the automatic download function. By starting the download on the PC, you automatically set the operating device to the download operating mode.

### 5.31.1 Automatic Download Function

You activate the automatic download function in the project's system parameters. Before you can use the function, you must (one time) load the project conventionally to the operating device using the automatic download function.

You can force each subsequent download when the operating device is running, by starting the download on the PC.

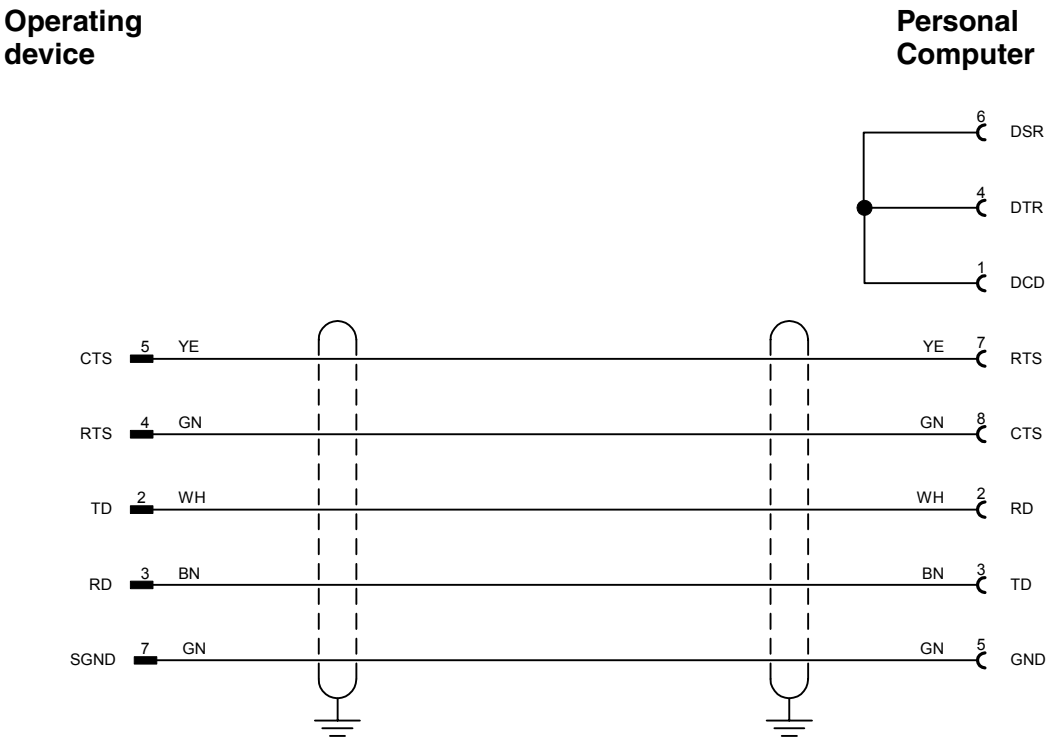
If you do this, the following data is lost in the operating device:

- Message data from the message memory
- All RAM data sets that were not saved
- All system parameters that were changed online (values of system variables, interfaces, passwords).

Standard Mode

## 5.31.2 Download Cable 25 Pin

This download cable applies to operating devices with a universal interface **only**.




D-SUB
male connector
25 pin

D-SUB
female connector
9 pin

Both ends of the shield are connected to the metallic housing of the connector.

## 5.32 Simulation Without a Controller (Demo Mode)

You can test the entire user interface for a project on the operating device without having a controller connected. Although this simulation permits the entry of variable values, the values are not transferred. As a result, you can test the range limits when values are being entered. You can also call help information for variables and masks, and test mask changes.

No communication occurs even if you connect a controller.

See chapter “Setting the Operating Mode“ on page 5-1.

# 6 Controller and Bus Connections

For more information on the individual connections possible for small operator terminals in the standard or bus models, see the following chapters. The same 25 pin D-SUB connector is used for small operator terminals of the standard model with a universal interface. For devices of the bus model, different connectors are used for the connection.

## 6.1 3964 RK512

The 3964/RK512 protocol allows you

- direct read-access to all PLC data
- indirect write-access to all PLC data if the supplied function block is used
- direct write-access to all data in a data block
- bit-access to all byte-oriented data types
- byte access to all data words in a data block.

### 6.1.1 Procedure of the 3964 Protocol

#### 6.1.1.1 Telegram for Connection Setup

The connection setup is initiated by the active partner. If the connection cannot be established successfully (passive partner sends NAK), the active partner will repeat the attempt 3 times.

If the connection setup is successful, but the passive partner transmits a NAK after receiving the data block, the active partner will make up to 6 attempts to establish the connection and to transmit the data.

| **Active Partner (Operating Device)** | **Data** | **Passive Partner** |
|---|---|---|
| Sending | STX | Receiving |
| Receiving | DLE (NAK) | Sending |
| Sending | Data | Receiving |
| Sending | DLE | Receiving |
| Sending | ETX | Receiving |
| Sending | BCC (optional) | Receiving |
| Receiving | DLE (NAK) | Sending |

Fig. 6-1: Connection set-up telegram for the 3964 procedure

The block check must be activated if the BCC (block check character) is to be added to the transmission.

3964 RK512

### 6.1.1.2 Data Request Telegram

| Active Partner (Operating Device) | Data | Passive Partner |
|---|---|---|
| Sending | STX | Receiving |
| Receiving | DLE | Sending |
| Sending | Telegram Header | Receiving |
| Sending | DLE | Receiving |
| Sending | ETX | Receiving |
| Sending | BCC (optional) | Receiving |
| Receiving | DLE | Sending |
| Receiving | STX | Sending |
| Sending | DLE | Receiving |
| Receiving | Response Telegram | Sending |
| Receiving | Data | Sending |
| Receiving | DLE | Sending |
| Receiving | ETX | Sending |
| Receiving | BCC | Sending |
| Sending | DLE | Receiving |

Fig. 6-2: Data Request telegram for the 3964 procedure

3964 RK512

### 6.1.1.3 Data Request Telegram Header

| Byte No. | Meaning | ASCII | Hex | Comment |
|---|---|---|---|---|
| 1 | Telegram ID | | 00 | Value is always 00 |
| 2 | | | | |
| 3 | Data direction | E | 45 | E = Request |
| 4 | Command | | | See chapter „Specification of the Data Types in the "Data Request" Telegram Header“ on page 6-4. |
| 5 | Source | | | See chapter „Specification of the Data Types in the "Data Request" Telegram Header“ on page 6-4. |
| 6 | | | | |
| 7 | Number | | | See chapter „Specification of the Data Types in the "Data Request" Telegram Header“ on page 6-4. |
| 8 | | | | |
| 9 | Coordination Flag No. | | | FF = Without Coordination Flag |
| 10 | Coordination Flag Bit | | | xF = Without Coordination Flag |

Fig. 6-3: Data Request Telegram header for the 3964 procedure

If you enter the value FFH for the coordination flag number and the value FH for the coordination flag bit into the protocol parameters, the monitoring function is deactivated.

## Specification of the Data Types in the "Data Request" Telegram Header

The operating device can access all of the data types of the controller. The data types are decoded in the telegram header as follows.

| Data Type | Mnemonics | Byte 4 (Command) | Byte 5 | Byte 6 | Byte 7 + 8 (Number) |
|---|---|---|---|---|---|
| Input Bit | E | E | Offset | Bit No. | 1 Byte |
| Input Byte | EB | E | Offset | | n Bytes |
| Input Word | EW | E | Offset | | n Bytes |
| Input Double-Word | ED | E | Offset | | n Bytes |
| Output Bit | A | A | Offset | Bit No. | 1 Byte |
| Output Byte | AB | A | Offset | | n Bytes |
| Output Word | AW | A | Offset | | n Bytes |
| Output Double-Word | AD | A | Offset | | n Bytes |

Fig. 6-4: Specification of the data types in the "Data Request" telegram header

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| Data Type | Mnemonics | Byte 4 (Com-mand) | Byte 5 | Byte 6 | Byte 7 + 8 (Number) |
|---|---|---|---|---|---|
| Flag Bit | M | M | Offset | Bit No. | 1 Byte |
| Flag Byte | MB | M | Offset | | n Bytes |
| Flag Word | MW | M | Offset | | n Bytes |
| Flag Double-Word | MD | M | Offset | | n Bytes |
| Data Word | DW | D | DB | DW | n Words |
| Data Word Left (High) | DL | D | DB | DW | 1 Word |
| Data Word Right (Low) | DR | D | DB | DW | 1 Word |
| Data Double-Word | DD | D | DB | DW | n Words |
| Timer | T | T | Offset | | n Words |
| Counter | Z | Z | Offset | | n Words |

Fig. 6-4: Specification of the data types in the "Data Request" telegram header

If you specified a coordination flag in the protocol parameters, this flag is set in the passive partner upon receipt of data. After processing the received data, the coordination flag is reset.

If the passive partner's coordination flag is set when it receives data, then the passive partner sends a response telegram to the active partner thereby indicating this as an error.

### 6.1.1.4 Response Telegram

| Byte No. | Meaning | ASCII | Hex | Comment |
|---|---|---|---|---|
| 1 | Telegram ID | | 00 | Value is always 00 |
| 2 | | | | |
| 3 | | | | Value is always 00 |
| 4 | Error Code | | xx | |

Fig. 6-5: Response telegram for the 3964 procedure

3964 RK512

### 6.1.1.5 Data Transmission Telegram

| Active Partner (Operating Device) | Data | Passive Partner |
|---|---|---|
| Sending | STX | Receiving |
| Receiving | DLE | Sending |
| Sending | Telegram Header | Receiving |
| Sending | DLE | Receiving |
| Sending | ETX | Receiving |
| Sending | BCC (optional) | Receiving |
| Receiving | DLE | Sending |
| Receiving | STX | Sending |
| Sending | DLE | Receiving |
| Receiving | Response Telegram | Sending |
| Receiving | DLE | Sending |
| Receiving | ETX | Sending |
| Receiving | BCC | Sending |
| Sending | DLE | Receiving |

Fig. 6-6: Data transmission telegram for the 3964 procedure

### 6.1.1.6 Data Transmission Telegram Header

The "Data Transmission" telegram header of the 3964 procedure has a size of 10 bytes.

When transmitting data, the destination is always a data block.

| Byte No. | Meaning | ASCII | Hex | Comment |
|---|---|---|---|---|
| 1 | Telegram ID | | 00 | Value is always 00 |
| 2 | | | | |
| 3 | Data direction | A | 41 | A = Transmission |
| 4 | Command | D | 44 | D = Data Block |
| 5 | Destination | | | Data Block |
| 6 | | | | Data Word |
| 7 | Number | | | Number of Words |

Fig. 6-7: Data transmission telegram header for the 3964 procedure

3964 RK512

| Byte No. | Meaning | ASCII | Hex | Comment |
|---|---|---|---|---|
| 8 | | | | |
| 9 | Coordination Flag No. | | | FF = Without Coordination Flag |
| 10 | Coordination Flag Bit | | | xF = Without Coordination Flag |

Fig. 6-7: Data transmission telegram header for the 3964 procedure

If you enter the value FFH for the coordination flag number and the value FH for the coordination flag bit into the protocol parameters, the monitoring function is deactivated.

### 6.1.1.7 Special Features of the 3964R Protocol

A write-access to data is possible in data blocks only. That means, only the data type DW allows a direct write-access to the respective destination.

To make sure you are still able to write-access all of the destinations, write the data into the data block you specified in the protocol parameters.

In this case, you need to add the destination specification (4 bytes) in front of the actual data.

#### Destination Information for a Write-Access via a Data Block

The destination information specified within the 4 bytes transmitted before the actual data is decoded as folllows.

| Data Type | Mnemonics | Byte 1 (Command) | Byte 2 (Number) | Byte 3 | Byte 4 |
|---|---|---|---|---|---|
| Input Bit | E | 10 | 1 Byte | Bit No. | Offset |
| Input Byte | EB | 1 | n Bytes | Offset | |
| Input Word | EW | 1 | n Bytes | Offset | |
| Input Double-Word | ED | 1 | n Bytes | Offset | |
| Output Bit | A | 11 | 1 Byte | Bit No. | Offset |
| Output Byte | AB | 2 | n Bytes | Offset | |
| Output Word | AW | 2 | n Bytes | Offset | |
| Output Double-Word | AD | 2 | n Bytes | Offset | |
| Flag Bit | M | 12 | 1 Byte | Bit No. | Offset |

Fig. 6-8: Specifying the destination information for a write-access via a data block

3964 RK512

| Data Type | Mnemonics | Byte 1 (Command) | Byte 2 (Number) | Byte 3 | Byte 4 |
|---|---|---|---|---|---|
| Flag Byte | MB | 3 | n Bytes | Offset | |
| Flag Word | MW | 3 | n Bytes | Offset | |
| Flag Double-Word | MD | 3 | n Bytes | Offset | |
| Data-Word Left (High) | DL | 26 | 1 Byte | DB | DW |
| Data-Word Right (Low) | DR | 27 | 1 Byte | DB | DW |
| Timer | T | 20 | n Bytes | Offset | |
| Counter | Z | 21 | n Bytes | Offset | |

Fig. 6-8: Specifying the destination information for a write-access via a data block

If you specified a coordination flag in the protocol parameters, this flag is set in the passive partner upon receipt of data. After processing the received data, the coordination flag is reset.

If the passive partner's coordination flag is set when it receives data, then the passive partner sends a response telegram to the active partner thereby indicating this as an error.

### Restrictions of the 3964R Protocol

With the 3964R protocol, a maximum of 128 bytes of data can be transmitted per telegram. No continuation telegrams are transmitted or processed.

## 6.1.2 Data Types

Direct access is possible to the following data types.

The size of each data area depends on the CPU of the PLC.

| Type | Mnemonics | Access |
|---|---|---|
| Input Bit | E | Bit Access (Read Access Only) |
| Input Byte | EB | Byte Access (Read Access Only) |
| Input Word | EW | Word Access (Read Access Only) |
| Input Double-Word | ED | Double-Word Access (Read Access Only) |
| Output Bit | A | Bit Access |
| Output Byte | AB | Byte Access |
| Output Word | AW | Word Access |
| Output Double-Word | AD | Double-Word Access |

Fig. 6-9: 3964 RK512 data types

3964 RK512

| Type | Mnemonics | Access |
|---|---|---|
| Flag Bit | M | Bit Access |
| Flag Byte | MB | Byte Access |
| Flag Word | MW | Word Access |
| Flag Double-Word | MD | Double-Word Access |
| Data Word | DW | Word Access |
| Data-Word Left (High) | DL | Word Access |
| Data-Word Right (Low) | DR | Word Access |
| Data Double-Word | DD | Double-Word Access |
| Timer | T | Word Access (Read Access Only) |
| Counter | Z | Word Access (Read Access Only) |

Fig. 6-9: 3964 RK512 data types

## 6.1.3 Programming

### 6.1.3.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### Baud Rate

This parameter specifies the communication rate.

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |

Fig. 6-10: Baud rate, 3964 RK512

3964 RK512

| Configurable Values (Baud) | Default value |
|---|---|
| 57600 | |
| 76800 | |
| 115200 | |

Fig. 6-10: Baud rate, 3964 RK512

## Parity

This parameter specifies the parity used to control the communication.

| Configurable Values | Default value |
|---|---|
| None | |
| Even | X |
| Odd | |

Fig. 6-11: Parity, 3964 RK512

## Handshake

This parameter specifies the method used to control the communication.

| Configurable Values | Default value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

Fig. 6-12: Handshake, 3964 RK512

3964 RK512

## Data Bits

This parameter specifies the number of data bits.

| Configurable Values | Default value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

Fig. 6-13: Data bits, 3964 RK512

## Stop Bits

This parameter specifies the number of stop bits.

| Configurable Values | Default value |
|---|---|
| 1 | |
| 1.5 | |
| 2 | X |

Fig. 6-14: Stop bits, 3964 RK512

## Use Coordination Flag

This parameter specifies whether you are using a coordination flag for the communication.

| Configurable Values | Default value |
|---|---|
| OFF | X |
| ON | |

Fig. 6-15: Use coordination flag, 3964 RK512

3964 RK512

## Coordination Flag

This parameter contains the number of the coordination flag you want to use for the communication. Specifying a value of 255 in conjunction with the bit number 15 deactivates the coordination function.

| Configurable Values | Default value |
|---|---|
| 0 to 255 | 0 |

Fig. 6-16: Coordination flag, 3964 RK512

## Bit Number

This parameter specifies the number of the bit in the coordination flag. Specifying a value of 15 in conjunction with the coordination flag number 255 deactivates the coordination function.

| Configurable Values | Default value |
|---|---|
| 0 to 15 | 0 |

Fig. 6-17: Bit number, 3964 RK512

## Data Block Number

This parameter contains the number of the data block to be used for the exchange of controller data.

| Configurable Values | Default value |
|---|---|
| Any values within the addressing range. | 10 |

Fig. 6-18: Data block number, 3964 RK512

## Data Block Word

This parameter specifies the offset of the data within the data block.

| Configurable Values | Default value |
|---|---|
| Any values within the addressing range. | 0 |

Fig. 6-19: Data block Word, 3964 RK512

3964 RK512

## Floating Point Number in the Siemens Format

This parameter specifies whether floating point numbers are exchanged in the Siemens-specific format or IEEE format.

| Configurable Values | Default value |
|---|---|
| IEEE Format | |
| Siemens Format | X |

Fig. 6-20: Floating point number, 3964 RK512

## Block Check

This parameter specifies the block check to be performed for the communication. The block check increases the communication speed.

| Configurable Values | Default value |
|---|---|
| OFF | X |
| ON | |

Fig. 6-21: Block check, 3964 RK512

## CPU Number

This parameter specifies the number of the CPU to be used for the communication.

| Configurable Values | Default value |
|---|---|
| 0 to 15 | 0 |

Fig. 6-22: CPU number, 3964 RK512

## Full Duplex

This parameter specifies whether the communication is performed in full duplex mode.

| Configurable Values | Default value |
|---|---|
| OFF | X |
| ON | |

Fig. 6-23: Full duplex, 3964 RK512

3964 RK512

## Half Duplex

This parameter specifies whether the communication is performed in half duplex mode.

| Configurable Values | Default value |
|---|---|
| OFF | X |
| ON | |

Fig. 6-24: Half duplex, 3964 RK512

3964 RK512

## 6.1.3.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

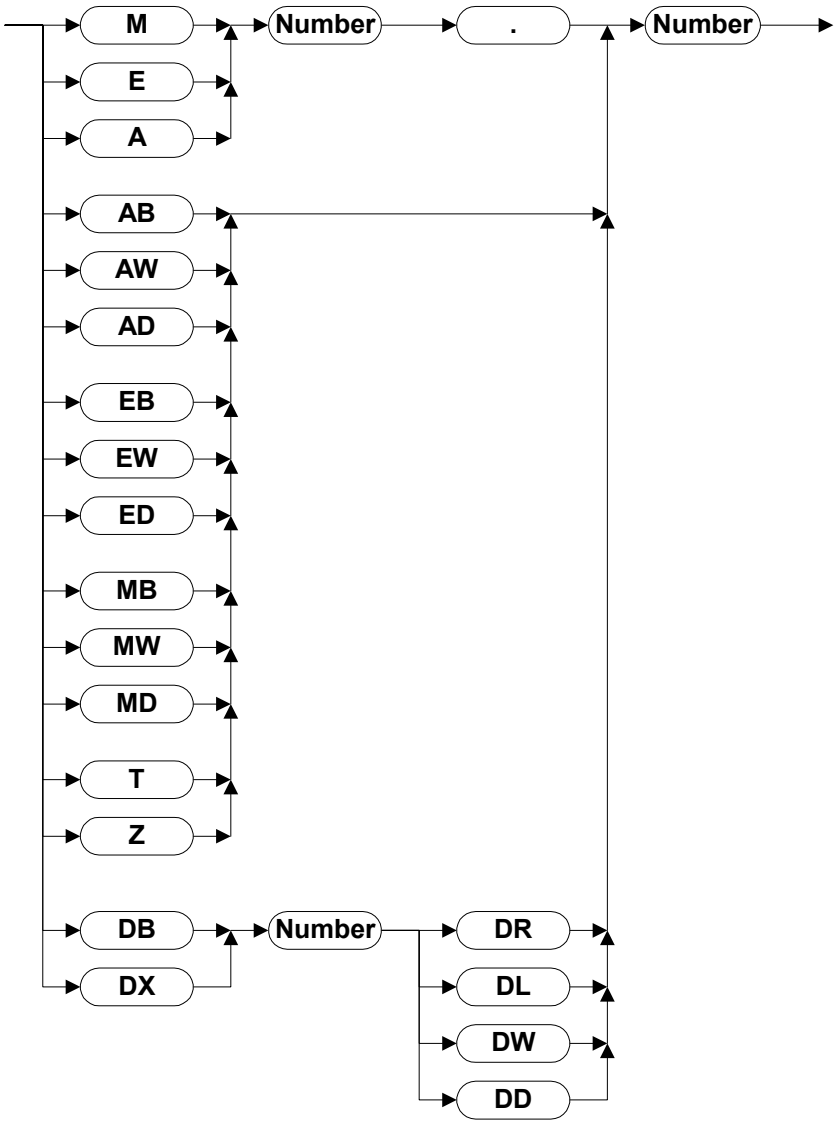



Fig. 6-25: Syntax diagram

3964 RK512

## 6.1.4 Physical Interfacing

Plug-in connections on the operating device for connecting to controllers with various communication modules.

### 6.1.4.1 Pin assignment for operating devices with a universal interface

| Pin | Designation | Function |
|---|---|---|
| 10 | T+ | Transmitted Data, Positive Polarity |
| 12 | S1+ | Power Source 1, Positive Polarity |
| 13 | R+ | Received Data, Positive Polarity |
| 14 | R- | Received Data, Negative Polarity |
| 16 | S2+ | Power Source 2, Positive Polarity |
| 19 | T- | Transmitted Data, Negative Polarity |
| 21 | S1- | Current Sink 1, Negative Polarity |
| 24 | S2- | Current Sink 2, Negative Polarity |

Fig. 6-26: Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

Fig. 6-27: Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

Fig. 6-28: Pin assignment RS485

3964 RK512

### 6.1.4.2 Pin assignment for operating devices without a universal interface

| Pin | Designation | Function |
|---|---|---|
| 1 | Shield | Shielding |
| 2 | T+ | Transmitted Data, Positive Polarity |
| 3 | S1+ | Power Source 1, Positive Polarity |
| 4 | R+ | Received Data, Positive Polarity |
| 5 | S2+ | Power Source 2, Positive Polarity |
| 6 | T- | Transmitted Data, Negative Polarity |
| 7 | S1- | Current Sink 1, Negative Polarity |
| 8 | R- | Received Data, Negative Polarity |
| 9 | S2- | Current Sink 2, Negative Polarity |

Fig. 6-29: Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

Fig. 6-30: Pin assignment RS232

3964 RK512

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

Fig. 6-31: Pin assignment X2 RS485

3964 RK512

## 6.1.5 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

| Code | Subcode | Type of Error | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | Wrong slave address or connecting cable not plugged-in properly |
| 2 | | Wrong character | Wrong interface parameters specified |
| 3 | | Byte framing error | |
| 4 | | Waiting time elapsed (Timeout) | Connection interrupted. |
| 5 | | CRC or BCC error | |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 11 | | Cyclic data already defined | |
| 15 | | Protocol error | The selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 40 | | System variable error | Undefined system variable |
| 50 | | Invalid acknowledgement during connection set-up | |
| 51 | | Invalid acknowledgement after transmission of data | |
| 52 | | No response telegram | |

Fig. 6-32: Error messages - 3964/RK512

3964 RK512

| Code | Subcode | Type of Error | Possible Cause |
|---|---|---|---|
| 53 | | Incorrect number of data received | Check if the mask, in which the error occured, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |
| Errors reported by the PLC via the response telegram. | | | |
| 61 | | 10 from PLC | No connection to PLC |
| 62 | | 16 from PLC | Wrong command in telegram |
| 63 | | 20 from PLC | Wrong destination addressed |
| 64 | | 50 from PLC | Coordination flag is still set |
| 65 | | 52 from PLC | Number of data transmitted does not comply with the number specified in the telegram header |
| 66 | | 54 from PLC | Awaiting continuation telegram |
| 70 | | The subcode contains the error transmitted by a CP525 or compatible module in the response telegram. | |
| | 10 | | No connection to PLC |
| | 12 | | Starting address too high. Use of coordination flag not permitted for this data type. CPU no. too high. |
| | 16 | | Wrong command letter |
| | 20 | | Illegal command. DB does not exist. DB too short. |
| | 50 | | Coordination flag still set |
| | 52 | | The number of data received exceeds the number requested. |
| | 54 | | Synchron. error (continuation telegram expected). |

Fig. 6-32: Error messages - 3964/RK512

## 6.2 3S Serial

The protocol provides random read and write access to all global data objects of the controller.

The programming software adopts the data objects of the project_name.SYM file which are created when the IndraLogic project is compiled.

The connected operating device uses the symbolic name to access a data object.

### 6.2.1 Data Types

The length of a variable is determined by the length defined in the programming software IndraLogic.

#### 6.2.1.1 Single Variables

You can access variables of the following type: BOOL, BYTE, WORD, DWORD, SINT, INT, DINT, USINT, UINT, UDINT, REAL, and STRING. Floating point numbers are interpreted in IEEE format. The variable type REAL is required for this purpose.

#### 6.2.1.2 String Variables

For string variables, the variable type STRING(N) is used, where N is the length of the string.

3S Serial

## 6.2.2 Programming

### 6.2.2.1 Protocol Parameters

#### Baud rate

This parameter specifies the communication rate.

| Configurable Values (Baud) | Default Value |
|---|---|
| 4800 | |
| 9600 | |
| 19200 | |
| 38400 | X |

Fig. 6-33: Baud rate

#### Parity

This parameter specifies the parity used to control the communication.

| Configurable Values | Default Value |
|---|---|
| None | X |
| Even | |
| Odd | |

Fig. 6-34: Parity

#### Data Bits

This parameter specifies the number of data bits.

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

Fig. 6-35: Data bits

## Stop Bits

This parameter specifies the number of stop bits.

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

Fig. 6-36: Stop bits

## Waiting Time for Response

Specify a waiting time for the Produced Data toggle bit monitoring.

| Configurable Values | Default Value |
|---|---|
| 0 ms, 50 ms to 65000 ms | 500 ms |

Fig. 6-37: Waiting time for response

## Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

| Configurable Values | Default Value |
|---|---|
| 5 s to 255 s | 5 s |

Fig. 6-38: Delay until Connection Set-Up

## Byte Order

This parameter specifies the destination hardware's CPU type.

| Configurable Values | Default Value |
|---|---|
| Intel | |
| Motorola | X |

Fig. 6-39: Byte order

## Controllers

This parameter is reserved for future extensions.

| Configurable Values | Default Value |
|---|---|
| Standard | X |
| PLCWinNT | |

Fig. 6-40: Controllers

## Path for Variable List *.sym

This parameter specifies the directory in which the variable list *.sym is stored.

To select a directory, click the Browse button.

The variable list *.sym is created by the programming software IndraLogic when compilation takes place.

### 6.2.2.2 System Parameters

## Poll Area

The poll area is used to manage the write coordination byte, the serial message channel and the LEDs in the function keys. This area is continuously polled by the operating device.

This protocol requires you to set up the poll area with three single variables.

| Area | Permitted Data Types |
|---|---|
| CBW | BYTE |
| Message Channel | WORD |
| LEDs in the Function Keys | ARRAY[1..N] OF BYTE |

Fig. 6-41: Dats types for the poll area

## Status Messages

Status messages are the static assignment of flags (bits) in the controller to plain text messages in the operating device. For status message addressing, use the data types ARRAY[1..N] OF BYTE or ARRAY[1..N] OF WORD.

| Data Type | Length of the message system in bytes |
|---|---|
| ARRAY OF BYTE | N |
| ARRAY OF WORD | N x 2 |

Fig. 6-42: Length of the Message System in Bytes

## Date and Time

The variables for synchronizing the time and date must use the data type ARRAY [1..N] OF BYTE.

| Variable | Length |
|---|---|
| Date with a 2-digit year | 3 Bytes |
| Date with a 4-digit year | 4 Bytes |
| Time | 3 Bytes |
| Weekday | 1 Byte |

Fig. 6-43: Byte lengths for the date and time

3S Serial

## 6.2.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

### 6.2.3.1 Pin assignment for operating devices with a universal interface

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

Fig. 6-44: Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

Fig. 6-45: Pin assignment RS485

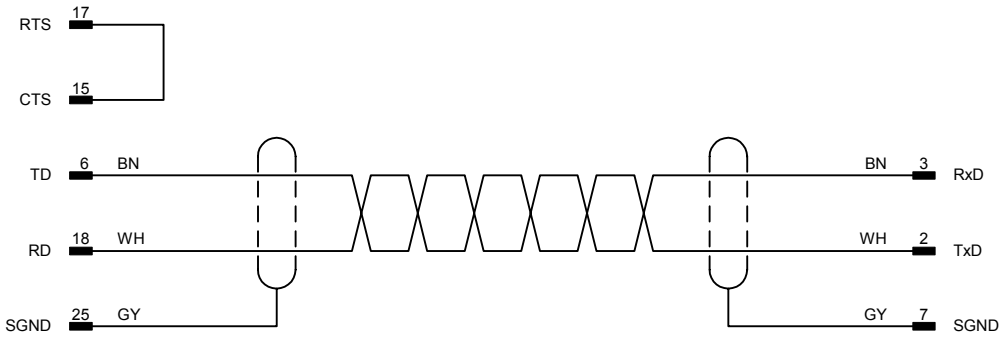
3S Serial

## 6.2.3.2 Cable X3 SER1 RS232 - Rexroth PPC-R

The following cabling diagram applies to operating devices with a universal interface **only**.

Operating device

Rexroth
PPC-R




D-SUB
male connector
25 pin

D-SUB
male connector
15 pin

Both ends of the shield are connected to the metallic housing.

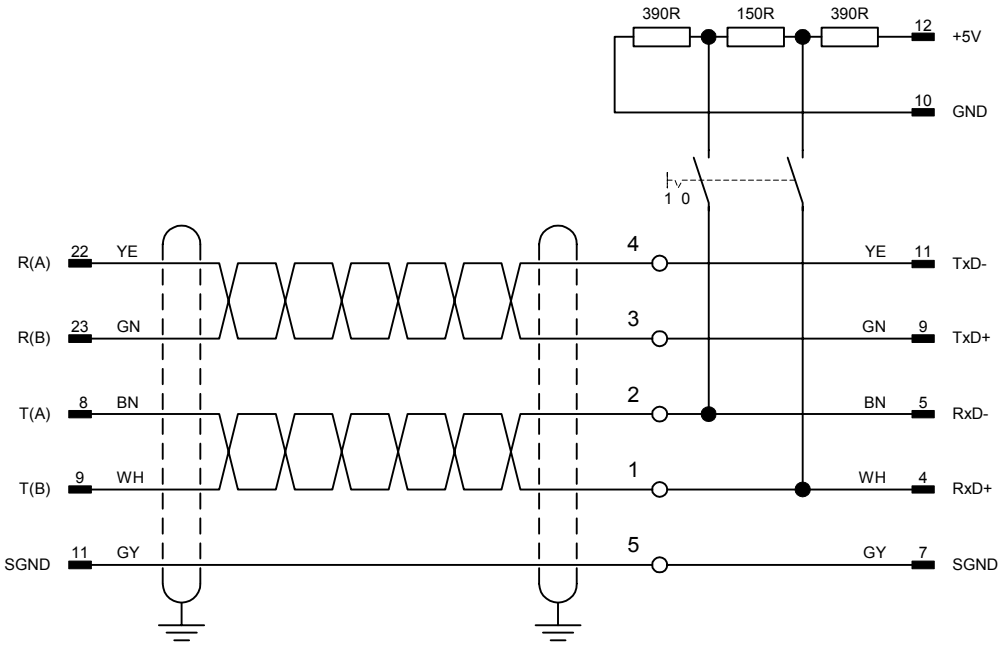
3S Serial

## 6.2.3.3 Cable X3 SER1 RS485 - Rexroth PPC-R

The following cabling diagram applies to operating devices with a universal interface **only**.

Operating device

Rexroth
PPC-R




D-SUB
male connector
25 pin

D-SUB
male connector
9 pin

Both ends of the shield are connected to the metallic housing.

3S Serial

## 6.2.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | 03 | Framing error on serial interface | |
| | 05 | CRC error on serial interface | |
| | 06 | Parity error on serial interface | |
| 60 | 10 | Wrong telegram length | |
| | 20 | Wrong telegram Ident Number | |
| | 30 | Wrong block number | |
| | 40 | Wrong checksum | |
| | 50 | Negative acknowledgement | |
| | 60 | Waiting time exceeded: No response | Cable interruption, connection cut-off, wrong baud rate |
| 70 | | Error from the controller | |

Fig. 6-46: Error messages for 3S serial

3S Serial

## 6.2.5 Applications

### 6.2.5.1 IndraLogic Version 1.0 or Higher

The programming software takes the global variables from the symbol file project_name.SYM and inserts them into the variable list.

The symbolic names cannot be longer than 80 characters.

The entries in the variable list cannot be modified.

#### Declaring Global Variables

To declare global variables in CoDeSys:

1. Select **Auto Declare** from the **Edit** menu.

The **Declare Variable** dialog opens.

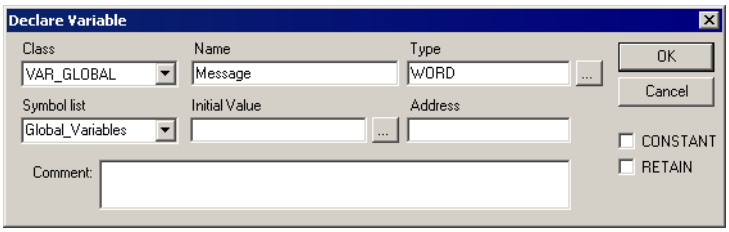



Fig. 6-47: Example of a variable declaration for global variables

2. Select the VAR_GOBAL class from the **Class** field.
3. Enter a name (Message) and a type (WORD).
4. Repeat step 3 for all additional global variables.
5. Click **OK** to confirm your input.

The **Global_Variables** window opens.

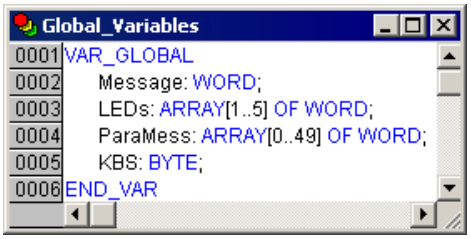



Fig. 6-48: Window 'Global variables'

#### Activate Output into Symbol File

Specify the following settings in IndraLogic to write the global variables into a symbolic file.

1. Select **Options** from the **Project** menu.
2. Select **Symbol configuration**.

The **Options** dialog will look as follows.

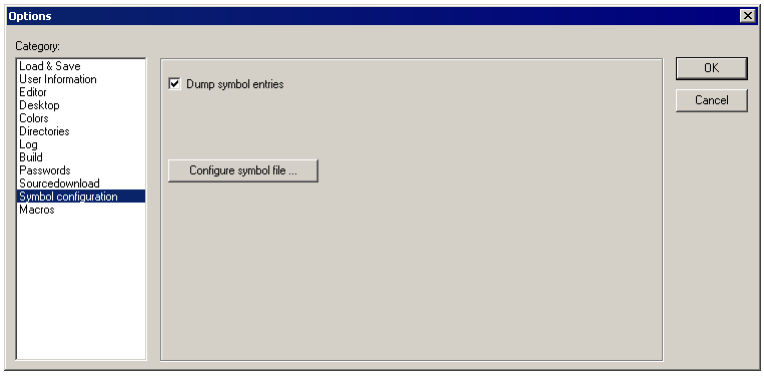



Fig. 6-49: Dialog 'Options' - symbol configuration

3. Select the **Dump symbol entries** check box.
4. Click the **Configure symbol file** button.

The **Set object attributes** window opens.

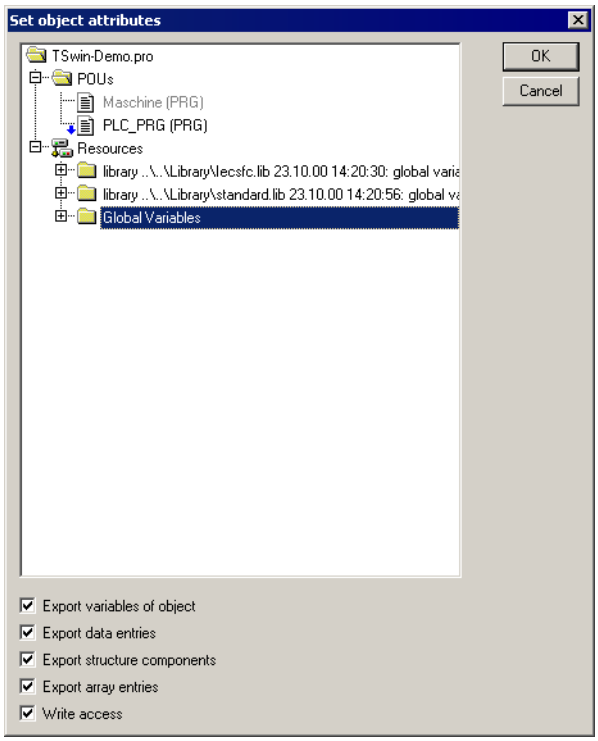



Fig. 6-50: Dialog 'Set object attributes'

5. Select the **Global variables** entry.
6. Click **OK** to confirm your selection.

You are returned to the **Options** dialog.

Now you need to specify the position where the symbol file is to be stored.

1. Select **Directories** from the **Options** dialog.

The **Options** dialog will look as follows.

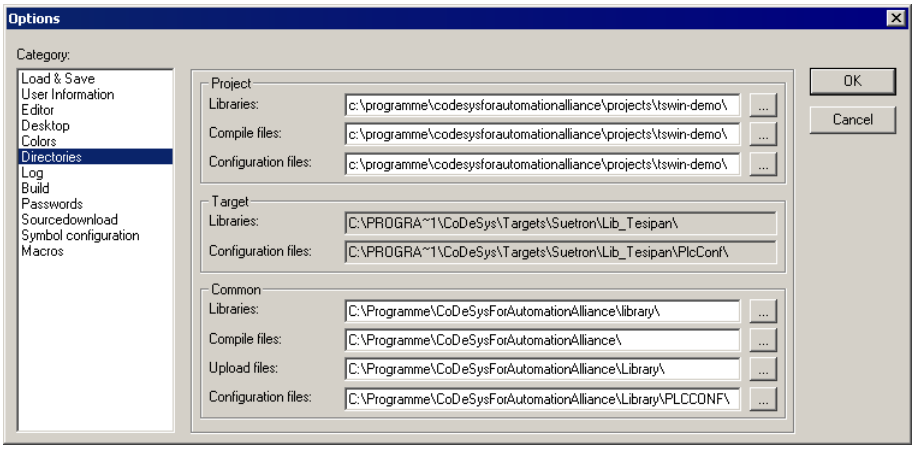



Fig. 6-51: Dialog 'Options' - directories

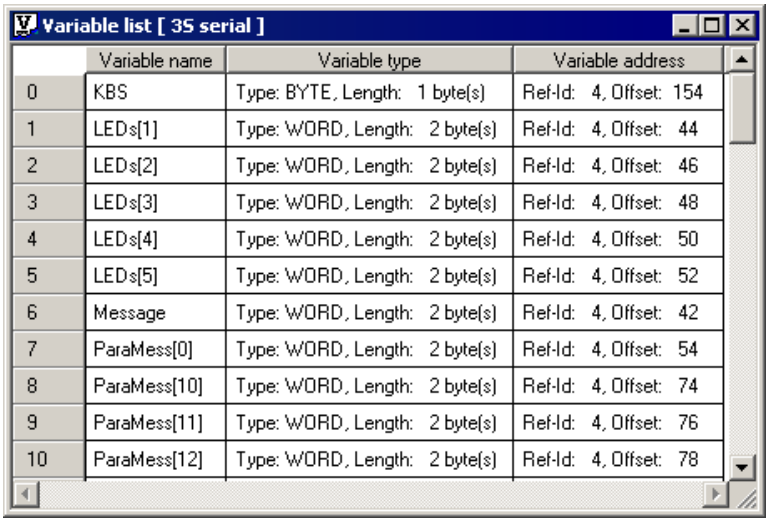
2. From the **Project** area, select a directory for the **compile files**.
3. Click **OK** to confirm your selection.

You are returned to the **Options** dialog.

The symbol file will not be created until a compilation process takes place and is stored in the same directory as the project!

## Variable List

The programming software automatically places the symbolic variable entries created in the example into the variable list if you specified the correct directory and name in the communications parameters.




| | Variable name | Variable type | Variable address |
|---|---|---|---|
| 0 | KBS | Type: BYTE, Length: 1 byte(s) | Ref-Id: 4, Offset: 154 |
| 1 | LEDs[1] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 44 |
| 2 | LEDs[2] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 46 |
| 3 | LEDs[3] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 48 |
| 4 | LEDs[4] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 50 |
| 5 | LEDs[5] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 52 |
| 6 | Message | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 42 |
| 7 | ParaMess[0] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 54 |
| 8 | ParaMess[10] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 74 |
| 9 | ParaMess[11] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 76 |
| 10 | ParaMess[12] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 78 |

Fig. 6-52: Variable list

3S Serial

This makes the variables globally available in the programming software and allows them to be selected in the **Mask element Variable** dialog as controller variables.

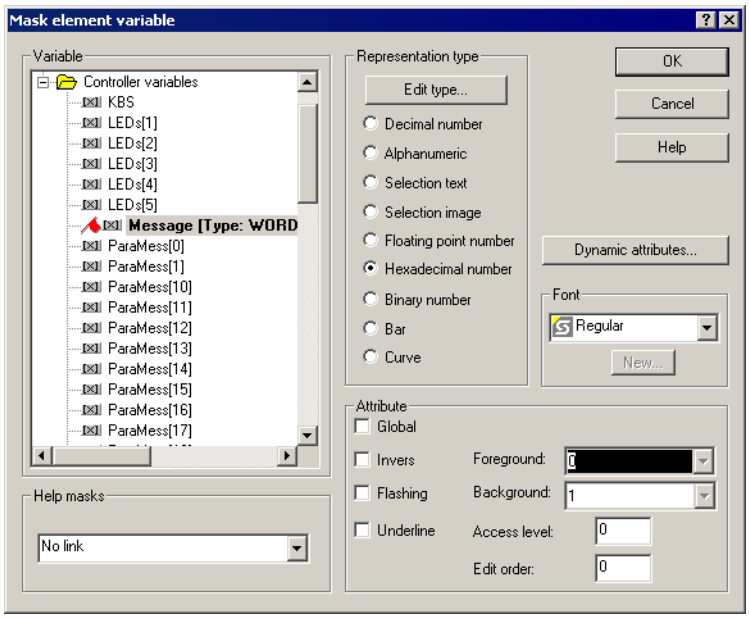



Fig. 6-53: Dialog 'Mask element Variable'

## 6.3 IndraLogic

The protocol provides random read and write access to all global data objects of the controller.

The programming software adopts the data objects of the project_name.SYM file which are created when the IndraLogic project is compiled.

The connected operating device uses the symbolic name to access a data object.

### 6.3.1 Data Types

The length of a variable is determined by the length defined in the programming software IndraLogic.

#### 6.3.1.1 Single Variables

You can access variables of the following type: BOOL, BYTE, WORD, DWORD, SINT, INT, DINT, USINT, UINT, UDINT, REAL, and STRING. Floating point numbers are interpreted in IEEE format. The variable type REAL is required for this purpose.

#### 6.3.1.2 String Variables

For string variables, the variable type STRING(N) is used, where N is the length of the string.

### 6.3.2 Programming

#### 6.3.2.1 Protocol Parameters

##### Baud rate

This parameter specifies the communication rate.

| Configurable Values (Baud) | Default Value |
|---|---|
| 4800 | |

Fig. 6-54: Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 9600 | |
| 19200 | |
| 38400 | X |

Fig. 6-54: Baud rate

## Parity

This parameter specifies the parity used to control the communication.

| Configurable Values | Default Value |
|---|---|
| None | X |
| Even | |
| Odd | |

Fig. 6-55: Parity

## Data Bits

This parameter specifies the number of data bits.

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

Fig. 6-56: Data bits

## Stop Bits

This parameter specifies the number of stop bits.

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

Fig. 6-57: Stop bits

## Waiting Time for Response

This parameter specifies how long the operating device waits for a response from the PLC.

| Configurable Values | Default Value |
|---|---|
| 100 ms to 25500 ms | 1000 ms |

Fig. 6-58: Waiting Time for Response

## Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

| Configurable Values | Default Value |
|---|---|
| 5 s to 255 s | 5 s |

Fig. 6-59: Delay until Connection Set-Up

## Byte Order

This parameter specifies the destination hardware's CPU type.

| Configurable Values | Default Value |
|---|---|
| Intel | |
| Motorola | X |

Fig. 6-60: Byteorder

## Controllers

This parameter is reserved for future extensions.

| Configurable Values | Default Value |
|---|---|
| Standard | X |
| PLCWinNT | |

Fig. 6-61: Control

## Path for Variable List *.sym

This parameter specifies the directory in which the variable list *.sym is stored.

To select a directory, click the Browse button.

The variable list *.sym is created by the programming software IndraLogic when compilation takes place.

### 6.3.2.2 System Parameters

## Poll Area

The poll area is used to manage the write coordination byte, the serial message channel and the LEDs in the function keys. This area is continuously polled by the operating device.

This protocol requires you to set up the poll area with three single variables.

| Area | Valid Data Types |
|---|---|
| KBS (write coordination byte) | BYTE, USINT, WORD, UINT |
| Message Channel | WORD, UINT |
| Function Key LEDs | BYTE, USINT, WORD, UINT, DWORD, UDINT, ARRAY[1..N] |

Fig. 6-62: Data types for the poll area

## Status Messages

Status messages are the static assignment of flags (bits) in the controller to plain text messages in the operating device. For status message addressing, use the data types BYTE, USINT, WORD, UINT, DWORD, UDINT, or ARRAY[1..N]. The following applies when using ARRAY:

The type size multiplied by N provides the size of the message system in bytes.

## Date and Time

The variables for synchronizing the time and date must use the data types USINT or ARRAY [1..N] OF BYTE.

| Variable | Length |
|---|---|
| Date with a 2-digit year | 3 Bytes |
| Date with a 4-digit year | 4 Bytes |
| Time | 3 Bytes |
| Weekday | 1 Byte |

Fig. 6-63: Byte lengths for the date and time

## 6.3.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

### 6.3.3.1 Pin assignment for operating devices with a universal interface

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

Fig. 6-64: Pin assignment SER1 RS232

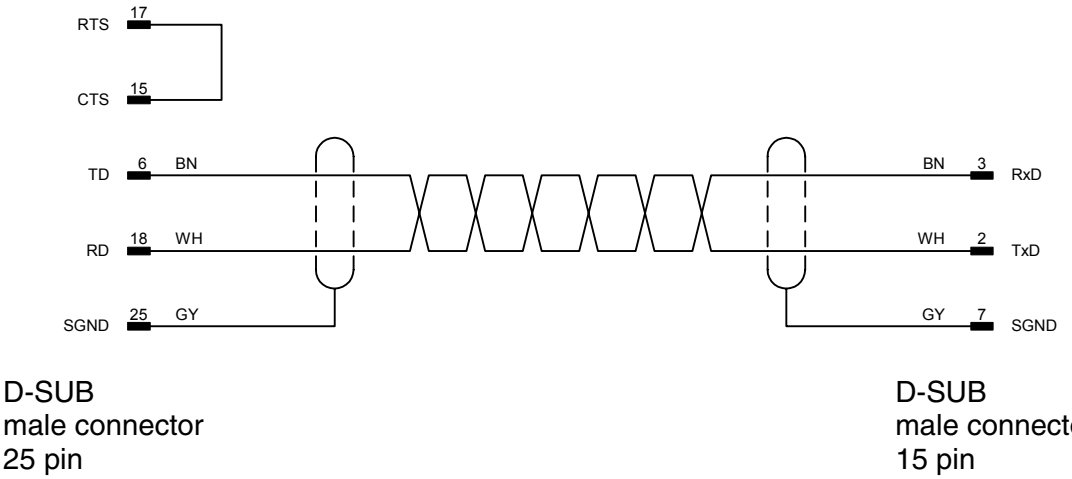
| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

Fig. 6-65: Pin assignment RS485

IndraLogic

## 6.3.3.2 Cabel X3 SER1 RS232 - Rexroth PPC-R

The following cabling diagram applies to operating devices with a universal interface **only**.



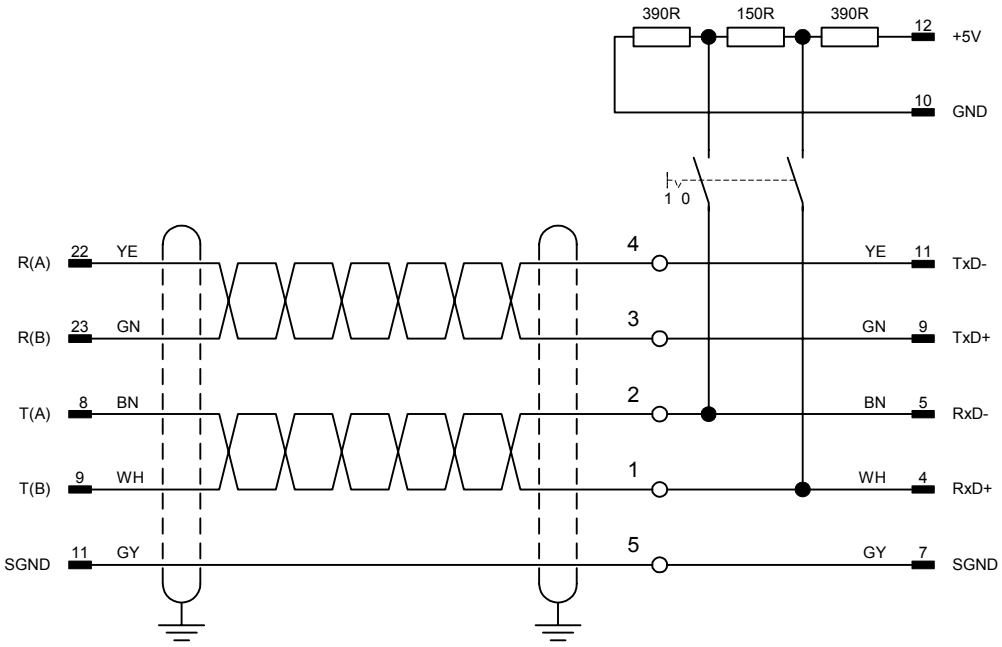

Both ends of the shield are connected to the metallic housing.

## 6.3.3.3 Cabel X3 SER1 RS485 - Rexroth PPC-R

The following cabling diagram applies to operating devices with a universal interface **only**.

Operating device

Rexroth
PPC-R




D-SUB
male connector
25 pin

D-SUB
male connector
9 pin

Both ends of the shield are connected to the metallic housing.

IndraLogic

## 6.3.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | 03 | Framing error on serial interface | |
| | 05 | CRC error on serial interface | |
| | 06 | Parity error on serial interface | |
| | 10 | Error on polling area | No polling area defined |
| 60 | 10 | Wrong telegram length | |
| | 20 | Wrong telegram Ident Number | |
| | 30 | Wrong block number | |
| | 40 | Wrong checksum | |
| | 50 | Negative acknowledgement | |
| | 60 | Waiting time exceeded: No response | Cable interruption, connection cut-off, wrong baud rate |
| 70 | | Error from the controller | |
| | 50 | No service | Wrong service code |
| | 51 | No variables list | Variables list missing in controller |
| 80 | 20 | Different variable types | You must compile the project with the latest symbol file and transfer it to the operating device again. |
| | 30 | Invalid symbol | |
| | 40 | Waiting time exeeded | There is no valid symbol list in the controller. Enter a larger value for the parameter delay until connection setup. |

Fig. 6-66: Error messages, IndraLogic

## 6.3.5 Applications

### 6.3.5.1 IndraLogic Version 1.0 or Higher

The programming software takes the global variables from the symbol file project_name.SYM and inserts them into the variable list.

The symbolic names cannot be longer than 80 characters.

The entries in the variable list cannot be modified.

#### Declaring Global Variables

To declare global variables in CoDeSys:

1. Select **Auto Declare** from the **Edit** menu.

The **Declare Variable** dialog opens.

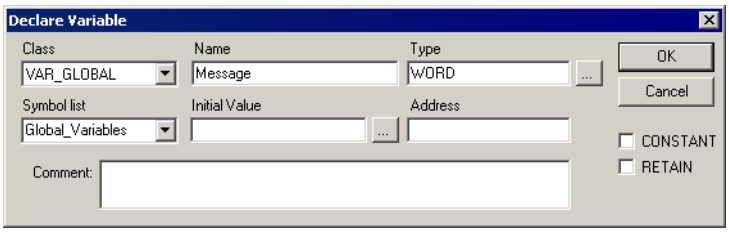



Fig. 6-67: Example of a variable declaration for global variables

2. Select the VAR_GOBAL class from the **Class** field.
3. Enter a name (Message) and a type (WORD).
4. Repeat step 3 for all additional global variables.
5. Click **OK** to confirm your input.

The **Global_Variables** window opens.

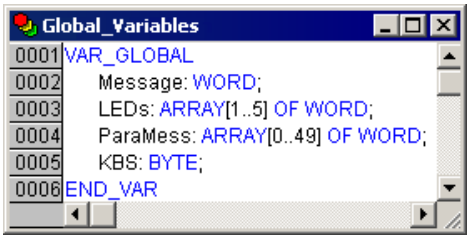



Fig. 6-68: Window 'Global variables'

#### Activate Output into Symbol File

Specify the following settings in IndraLogic to write the global variables into a symbolic file.

1. Select **Options** from the **Project** menu.
2. Select **Symbol configuration**.

The **Options** dialog will look as follows.

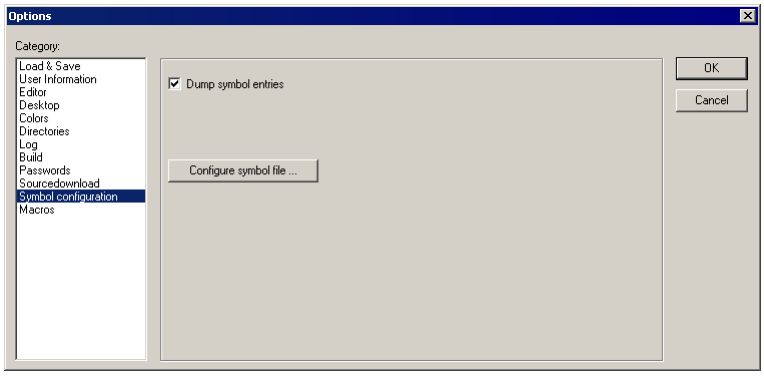



Fig. 6-69: Dialog 'Options' - symbol configuration

3. Select the **Dump symbol entries** check box.
4. Click the **Configure symbol file** button.

The **Set object attributes** window opens.

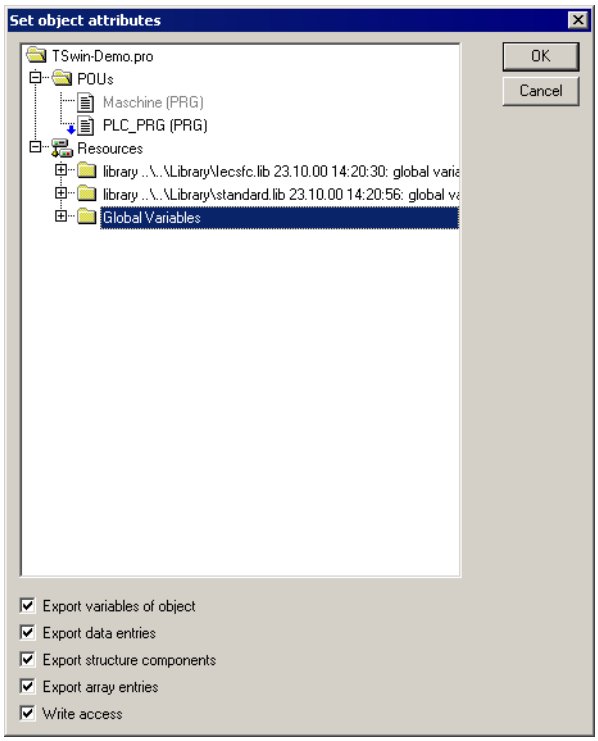



Fig. 6-70: Dialog 'Set object attributes'

5. Select the **Global variables** entry.
6. Click **OK** to confirm your selection.

You are returned to the **Options** dialog.

Now you need to specify the position where the symbol file is to be stored.

1. Select **Directories** from the **Options** dialog.

The **Options** dialog will look as follows.

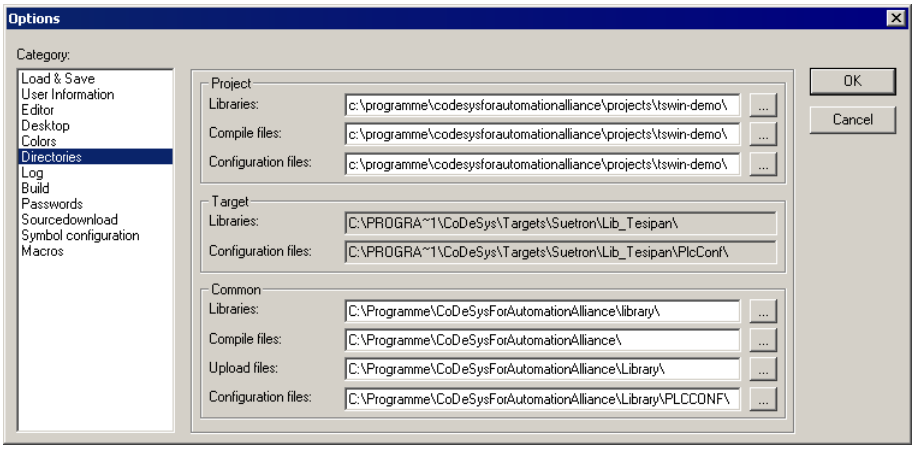



Fig. 6-71: Dialog 'Options' - directories

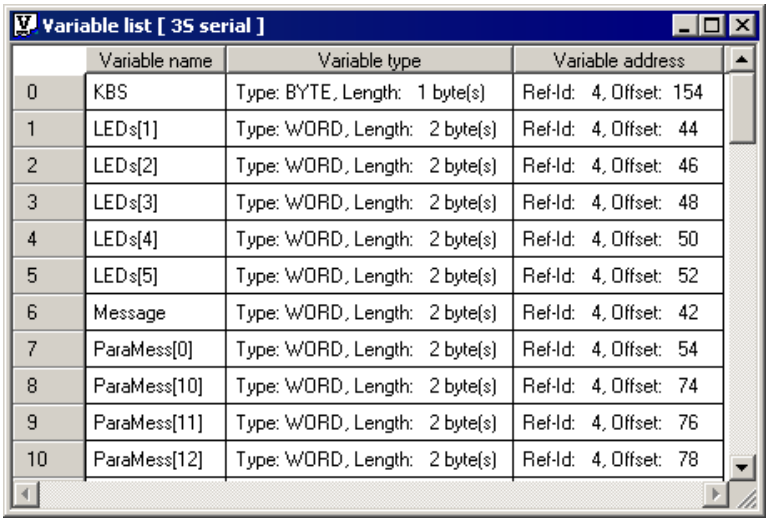
2. From the **Project** area, select a directory for the **compile files**.
3. Click **OK** to confirm your selection.

You are returned to the **Options** dialog.

The symbol file will not be created until a compilation process takes place and is stored in the same directory as the project!

## Variable List

The programming software automatically places the symbolic variable entries created in the example into the variable list if you specified the correct directory and name in the communications parameters.




| | Variable name | Variable type | Variable address |
|---|---|---|---|
| 0 | KBS | Type: BYTE, Length: 1 byte(s) | Ref-Id: 4, Offset: 154 |
| 1 | LEDs[1] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 44 |
| 2 | LEDs[2] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 46 |
| 3 | LEDs[3] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 48 |
| 4 | LEDs[4] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 50 |
| 5 | LEDs[5] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 52 |
| 6 | Message | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 42 |
| 7 | ParaMess[0] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 54 |
| 8 | ParaMess[10] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 74 |
| 9 | ParaMess[11] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 76 |
| 10 | ParaMess[12] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 78 |

Fig. 6-72: Variable list

This makes the variables globally available in the programming software and allows them to be selected in the **Mask element Variable** dialog as controller variables.

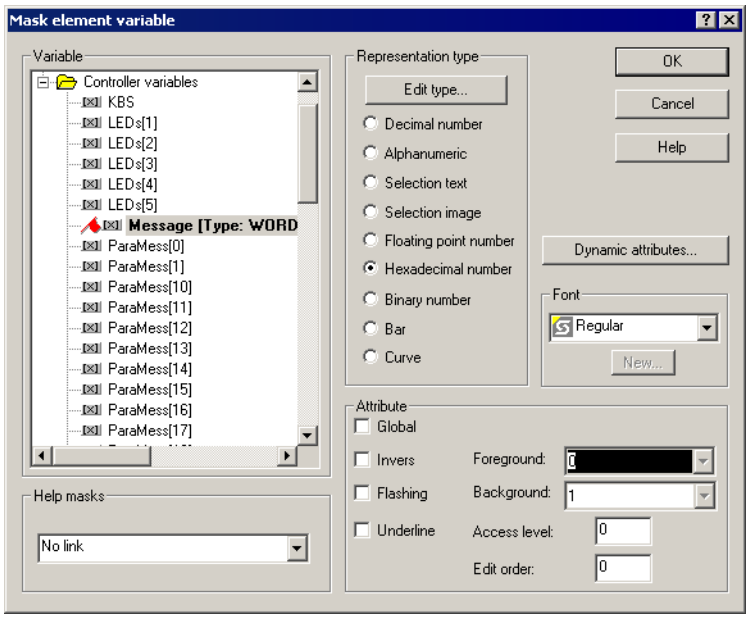



Fig. 6-73: Dialog 'Mask element Variable'

## 6.4 Bosch BUEP19

The Bosch BUEP19 protocol allows you:

- random read and write access to all PLC data
- bit-by-bit access to all byte, word and double-word oriented data types
- byte-by-byte access to all data words in a data block.

When the system writes to individual bits and individual bytes of a flag word, a read-access is performed first. Then, the entire data structure can be accessed for a write operation. During this type of access, you must therefore take care that the operating device and the controller do not modify individual bits in a byte (or individual bytes in a data word).

The size of the address area depends on the controller being used.

This protocol supports a connection to the following CPU modules:

- ZE300
- ZE301
- R300
- R301
- R600

### 6.4.1 Data Types

Direct access is possible to the following data types.

The size of the individual data areas depends on the controller of the controller's CPU.

| Type | Mnemonic | Access |
|---|---|---|
| Input Bit | BE | Bit Access |
| Input Byte | BYE | Byte Access |
| Input Word | WE | Word Access |
| Input Double-Word | DWE | Word Access |
| Output Bit | BA | Bit Access |
| Output Byte | BYA | Byte Access |
| Output Word | WA | Word Access |
| Output Double-Word | DWA | Word Access |
| Flag Bit | BM | Bit Access |
| Flag Byte | BYM | Byte Access |
| Flag Word | WM | Word Access |

Fig. 6-74: Data types for Bosch BUEP19

Bosch BUEP19

| Type | Mnemonic | Access |
|---|---|---|
| Flag Double-Word | DWM | Word Access |
| Timer Word | WT | Word Access, R300 and R600 read-only |
| Counter Word | WZ | Word Access, R300 and R600 read-only |
| Data Buffer Word | WDP | Word Access0 to 510 for ZE300<br>Access is possible to even-numbered addresses only. |
| Data Word | DBxWD | Word Access0 to 510<br>Access is possible to even-numbered addresses only |
| Data Double-Word | DBxDWD | Word Access<br>Access is possible to even-numbered addresses only |

Fig. 6-74: Data types for Bosch BUEP19

**Counter:** When a counter address is accessed, the counter value is interpreted in binary form. The maximum counter value is 8191.

**Timer:** Timer values are made up of a time value and a time base.

The operating device reads the 2-byte variable and converts it internally into an imaginary, unsigned 4-byte variable, that represents the time value in reference for the base 0.01 seconds.

Before the operating device writes a timer value to the controller, it converts the unsigned 4-byte variable back into a 2-byte variable with a time value for the smallest possible time base.

## 6.4.2 Programming

### 6.4.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used. All parameters are set to the default values which ensure a reliable communication.

## Baud Rate

This parameter specifies the communication rate.

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | X |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

Fig. 6-75: Baud rate, Bosch BUEP19

## Parity

This parameter specifies the parity used to control the communication.

| Configurable Values | Default value |
|---|---|
| None | |
| Even | X |
| Odd | |

Fig. 6-76: Parity, Bosch BUEP19

## Handshake

This parameter specifies the method used to control the communication.

| Configurable Values | Default value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

Fig. 6-77: Handshake, Bosch BUEP19

## Data Bits

This parameter specifies the number of data bits.

| Configurable Values | Default value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

Fig. 6-78: Data bits, Bosch BUEP19

## Stop Bits

This parameter specifies the number of stop bits.

| Configurable Values | Default value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

Fig. 6-79: Stop bits, Bosch BUEP19

## Use Coordination Flag

This parameter specifies whether you are using a coordination flag for the communication.

| Configurable Values | Default value |
|---|---|
| OFF | X |
| ON | |

Fig. 6-80: Use coordination flag, Bosch BUEP19

## Coordination Flag

This parameter contains the number of the coordination flag you want to use for the communication.

| Configurable Values | Default value |
|---|---|
| 0 to 255 | 0 |

Fig. 6-81: Coordination flag, Bosch BUEP19

## Bit Number

This parameter specifies the number of the bit in the coordination flag.

| Configurable Values | Default value |
|---|---|
| 0 to 7 | 0 |

Fig. 6-82: Bit number, Bosch BUEP19

## Destination Module

This parameter specifies the CPU module you are using.

| Configurable Values | Default value |
|---|---|
| ZE300/ZE301 | X |
| R300/R300B | |
| R600/R600B | |

Fig. 6-83: Destination module, Bosch BUEP19

Bosch BUEP19

### Block Check

This parameter specifies the block check to be performed for the communication.

| Configurable Values | Default value |
|---|---|
| CRC16 | |
| LRC8 | X |

Fig. 6-84: Block check, Bosch BUEP19

## 6.4.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

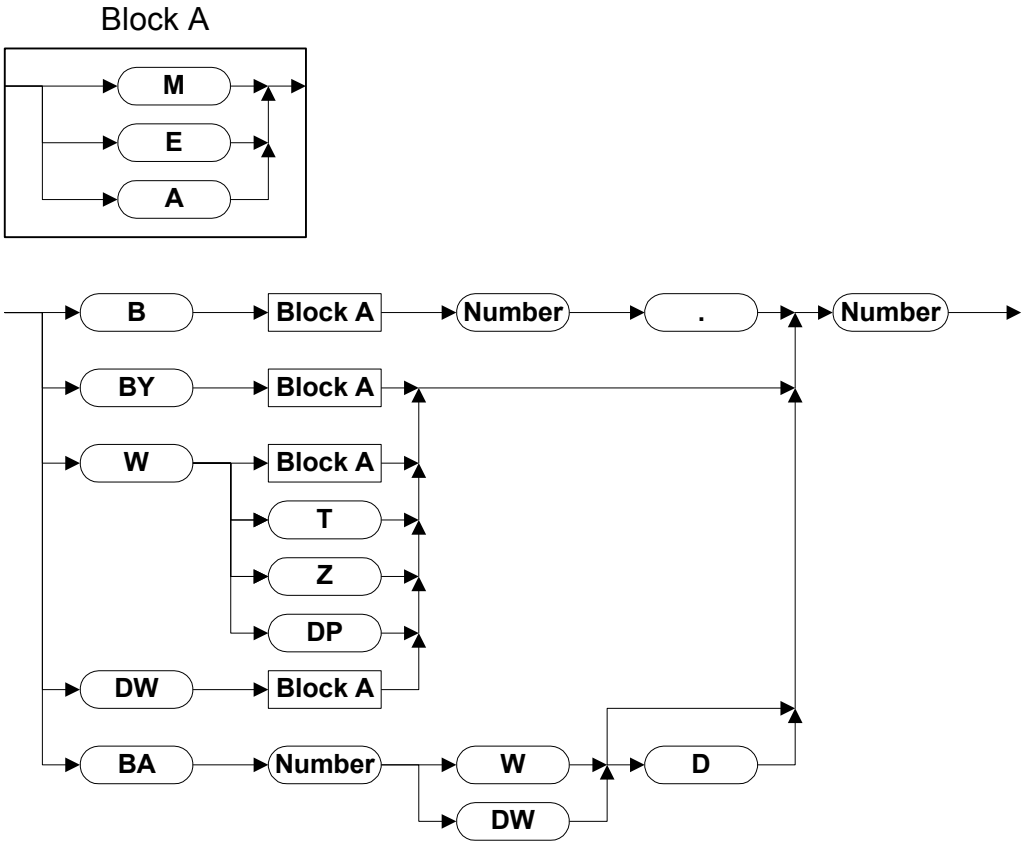



Fig. 6-85: Syntax diagram for Bosch BUEP19

Bosch BUEP19

## 6.4.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

### 6.4.3.1 Pin assignment for operating devices with a universal interface

| Pin | Designation | Function |
|---|---|---|
| 10 | T+ | Transmitted Data, Positive Polarity |
| 12 | S1+ | Power Source 1, Positive Polarity |
| 13 | R+ | Received Data, Positive Polarity |
| 14 | R- | Received Data, Negative Polarity |
| 16 | S2+ | Power Source 2, Positive Polarity |
| 19 | T- | Transmitted Data, Negative Polarity |
| 21 | S1- | Current Sink 1, Negative Polarity |
| 24 | S2- | Current Sink 2, Negative Polarity |

Fig. 6-86: Pin assignment TTY / 20 mA, active

### 6.4.3.2 Pin assignment for operating devices without a universal interface

| Pin | Designation | Function |
|---|---|---|
| 1 | Shield | Shielding |
| 2 | T+ | Transmitted Data, Positive Polarity |
| 3 | S1+ | Power Source 1, Positive Polarity |
| 4 | R+ | Received Data, Positive Polarity |
| 5 | S2+ | Power Source 2, Positive Polarity |
| 6 | T- | Transmitted Data, Negative Polarity |
| 7 | S1- | Current Sink 1, Negative Polarity |
| 8 | R- | Received Data, Negative Polarity |
| 9 | S2- | Current Sink 2, Negative Polarity |

Fig. 6-87: Pin assignment TTY / 20 mA, active

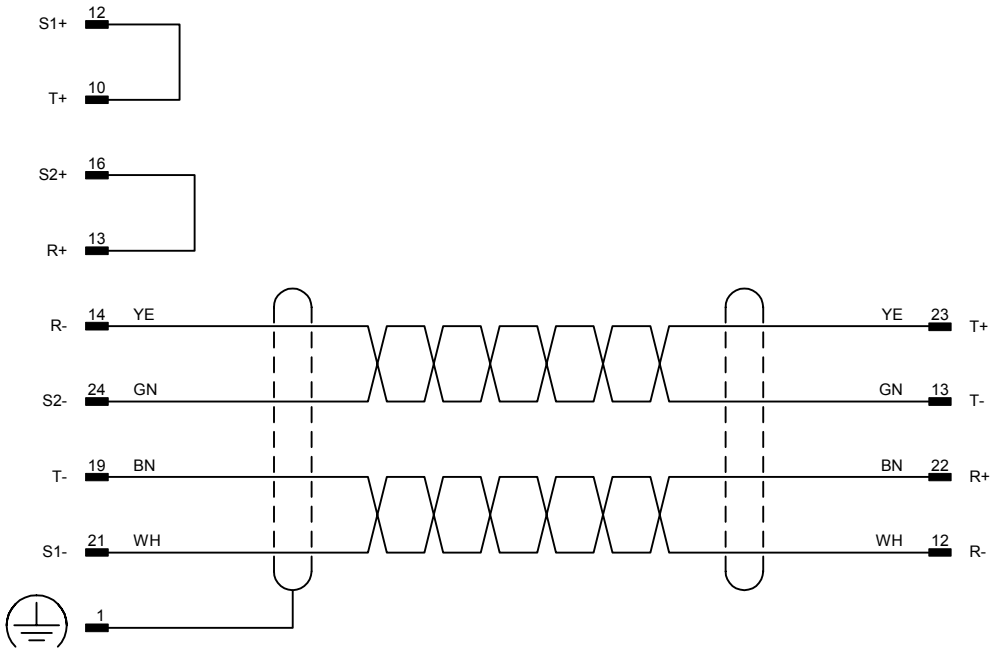
Bosch BUEP19

## 6.4.3.3 Cable X3 SER1 TTY / 20 mA - Bosch PU

The following cabling diagram applies to operating devices with a universal interface **only**.

Operating device
Transmitter active
Receiver active

Bosch
e.g. Z301
Transmitter passive
Receiver passive




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing.

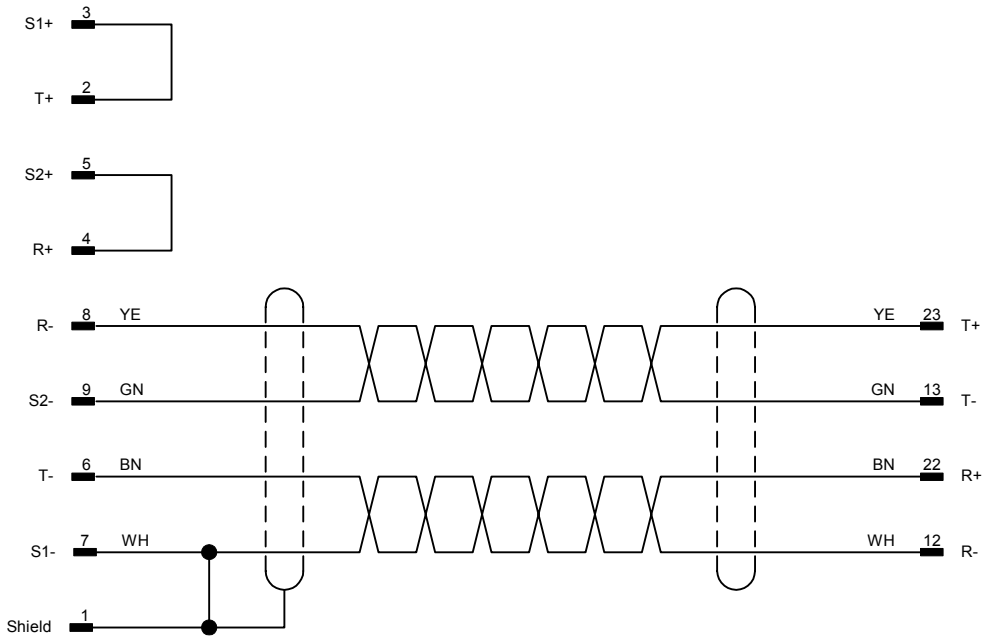
Bosch BUEP19

## 6.4.3.4 Cable X2 TTY / 20 mA - Bosch PU

The following cabling diagram does **not** apply to operating devices with a universal interface.

Operating device
Transmitter active
Receiver active

Bosch
e.g. Z301
Transmitter passive
Receiver passive




D-SUB
male connector
9 pin

D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing.

Bosch BUEP19

## 6.4.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | Wrong baud rate or cable defective |
| 2 | | Packets out of sequence | |
| 3 | | Error in protocol frame | |
| 4 | | Waiting time elapsed (Timeout) | Connection interrupted. |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 12 | | Cyclic data already defined | |
| 15 | | Protocol error | The selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 40 | | System variable error | Undefined system variable |
| Bosch-Specific Error Messages | | | |
| 50 | | No connection set-up | |
| 51 | | Wrong acknowledgement during connection set-up | |
| 52 | | Wrong acknowledgement after sending information block | |
| 53 | | No response telegram | |
| 54 | | Timeout - No response telegram | |
| 55 | | Block time exceeded | |
| 56 | | No acknowledgement | |
| 57 | | EOT - Aborted by controller | |

Fig. 6-88: Error Messages for Bosch BUEP19

Bosch BUEP19

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 58 | | Incorrect number of data received | Check if the mask, in which the error occured, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |
| Error from Programmable Controller | | | |
| 62 | | 32 from programmable controller | Write access to T or Z to module not allowed. |
| 67 | | 37 from programmable controller | Wrong parameter |
| 68 | | 38 from programmable controller | Number of bytes received is incorrect according to message header |
| 69 | | 39 from programmable controller | Wrong P1 for system message |
| 71 | | 41 from programmable controller | Direction not defined |
| 72 | | 42 from programmable controller | DB too small |
| 74 | | 44 from programmable controller | DB not programmed |
| 76 | | 46 from programmable controller | DB not defined |
| 78 | | 48 from programmable controller | Block type unknown |
| 79 | | 49 from programmable controller | Parameter 2 is 0 |
| 94 | | 64 from programmable controller | Wrong telegram type |

Fig. 6-88: Error Messages for Bosch BUEP19

## 6.5 Bosch BUEP19E

The Bosch BUEP19E protocol allows you:

– random read and write access to all PLC data
– bit-by-bit access to all byte, word and double-word oriented data types
– byte-by-byte access to all data words in a data block.

The size of the address area depends on the controller being used.

This protocol supports a connection to the following CPU modules:

– CL200
– CL350
– CL400
– CL500

### 6.5.1 Data Types

Direct access is possible to the following data types.

The size of the individual data areas depends on the controller of the controller's CPU.

| Type | Mnemonic | Access |
|---|---|---|
| Input Bit | BE | Bit Access |
| Input Byte | BYE | Byte Access |
| Input Word | WE | Word Access |
| Input Double-Word | DWE | Word Access |
| Output Bit | BA | Bit Access |
| Output Byte | BYA | Byte Access |
| Output Word | WA | Word Access |
| Output Double-Word | DWA | Word Access |
| Flag Bit | BM | Bit Access |
| Flag Byte | BYM | Byte Access |
| Flag Word | WM | Word Access |
| Flag Double-Word | DWM | Word Access |
| Timer Word | WT | Word Access<br>0 to 127 |
| Counter Word | WZ | Word Access<br>0 to 127 |

Fig. 6-89: Data types for Bosch BUEP19E

Bosch BUEP19E

| Type | Mnemonic | Access |
|---|---|---|
| Data Buffer Byte | BYDP | Byte Access<br>0 to 511 |
| Data Buffer Word | WDP | Word Access<br>0 to 511 |
| Data Block Byte | DBxBYD | Byte Access<br>0 to 511 |
| Data Block Word | DBxWD | Word Access<br>0 to 511 |
| Data Block Double-Word | DBxDWD | Word Access |
| Data Field Byte | BLxBYDF | Byte Access<br>0 to 24575 |
| Data Field Word | BLxWDF | Word Access<br>0 to 24575 |
| Data Field Double-Word | BLxDWDF | Word Access<br>0 to 24575 |

Fig. 6-89: Data types for Bosch BUEP19E

**Counter:** When a counter address is accessed, the counter value is interpreted in binary form. The maximum counter value is 8191.

**Timer:** Timer values are made up of a time value and a time base.

The operating device reads the 2-byte variable and converts it internally into an imaginary, unsigned 4-byte variable, that represents the time value in reference for the base 0.01 seconds.

Before the operating device writes a timer value to the controller, it converts the unsigned 4-byte variable back into a 2-byte variable with a time value for the smallest possible time base.

**Data field:** If you defined the data field as a linear area, the data field number must be set to the value 255.

Bosch BUEP19E

## 6.5.2 Programming

### 6.5.2.1 Protocol Parameters

You can use the protocol parameters to influence the communication between the operating device and the controller. All parameters are set to the default values which ensure a reliable communication.

#### Baud Rate

This parameter specifies the communication rate.

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | X |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

Fig. 6-90: Baud rate, Bosch PU BUEP19E

#### Parity

This parameter specifies the parity used to control the communication.

| Configurable Values | Default value |
|---|---|
| None | |
| Even | X |
| Odd | |

Fig. 6-91: Parity, Bosch PU BUEP19E

## Handshake

This parameter specifies the method used to control the communication.

| Configurable Values | Default value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

Fig. 6-92: Handshake, Bosch PU BUEP19E

## Data Bits

This parameter specifies the number of data bits.

| Configurable Values | Default value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

Fig. 6-93: Data bits, Bosch PU BUEP19E

## Stop Bits

This parameter specifies the number of stop bits.

| Configurable Values | Default value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

Fig. 6-94: Stop bits, Bosch PU BUEP19E

Bosch BUEP19E

## Use Coordination Flag

This parameter specifies whether you are using a coordination flag for the communication.

| Configurable Values | Default value |
|---|---|
| OFF | X |
| ON | |

Fig. 6-95: Use coordination flag, Bosch PU BUEP19E

## Coordination Flag

This parameter contains the number of the coordination flag you want to use for the communication.

| Configurable Values | Default value |
|---|---|
| 0 to 255 | 0 |

Fig. 6-96: Coordination flag, Bosch PU BUEP19E

## Process Coordination Flag

This parameter specifies the number of the process coordination flag.

| Configurable Values | Default Value |
|---|---|
| 0 (System stop state) | X |
| 1 (System RUN state) | |
| 2 (I/O status) | |
| 3 (I/O status or STOP | |
| 4 (PE) | |
| 5 (PE or STOP) | |
| 6 (OB1) | |
| 7 (OB1 or STOP) | |
| 15 (no process coordination) | |

Fig. 6-97: Process coordination flag, Bosch PU BUEP19E

Bosch BUEP19E

## Destination Module

This parameter specifies the CPU module you are using.

| Configurable Values | Default value |
|---|---|
| CL500 | X |
| CL350/CL400 | |
| CL200 | |

Fig. 6-98: Destination module, Bosch PU BUEP19E

## Block Check

This parameter specifies the block check to be performed for the communication.

| Configurable Values | Default value |
|---|---|
| CRC16 | |
| LRC8 | X |

Fig. 6-99: Block check, Bosch PU BUEP19E

Bosch BUEP19E

## 6.5.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

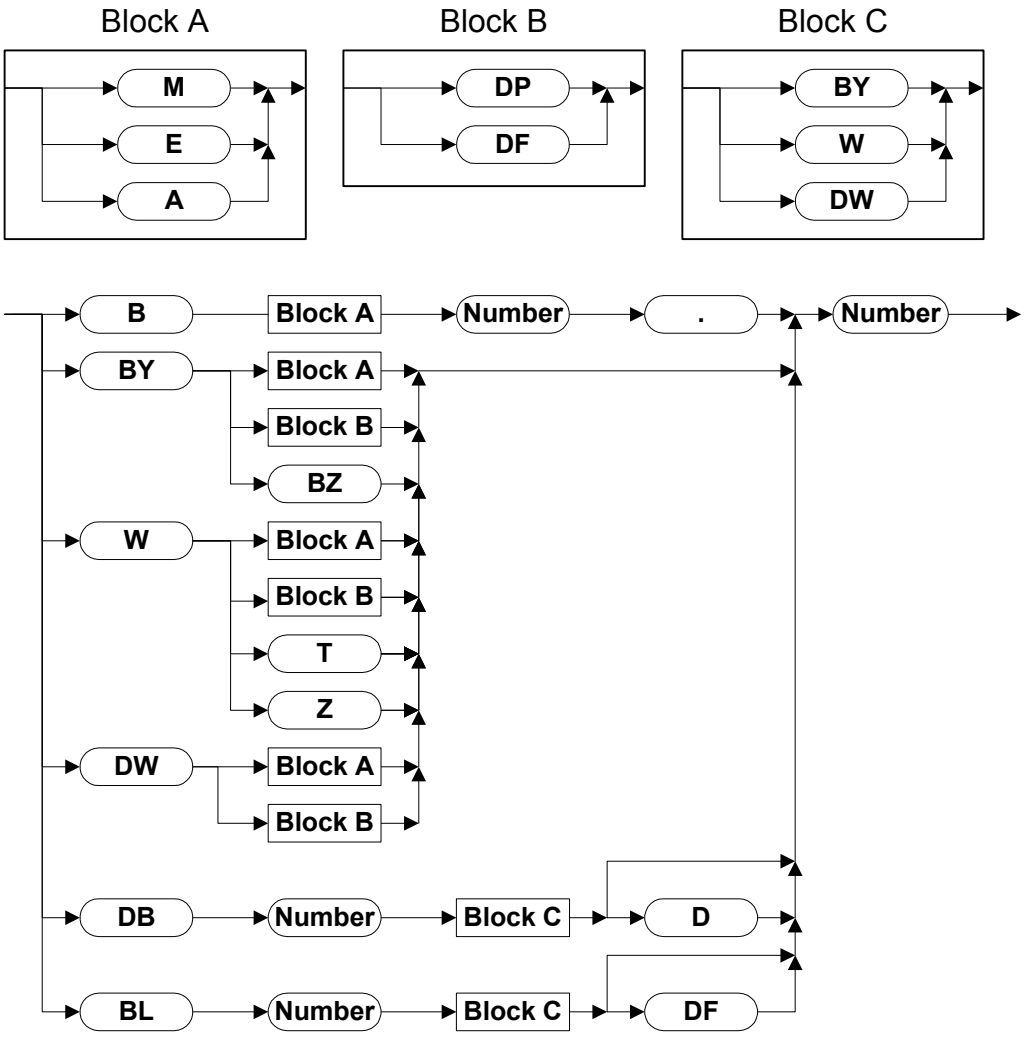



Fig. 6-100: Syntax diagram for Bosch BUEP19E

Bosch BUEP19E

## 6.5.3 Physical Interfacing

Steckverbindungen am Bediengerät für den Anschluss an die PG-Schnittstelle der Bosch Steuerung.

### 6.5.3.1 Pin assignment for operating devices with a universal interface

| Pin | Designation | Function |
|---|---|---|
| 10 | T+ | Transmitted Data, Positive Polarity |
| 12 | S1+ | Power Source 1, Positive Polarity |
| 13 | R+ | Received Data, Positive Polarity |
| 14 | R- | Received Data, Negative Polarity |
| 16 | S2+ | Power Source 2, Positive Polarity |
| 19 | T- | Transmitted Data, Negative Polarity |
| 21 | S1- | Current Sink 1, Negative Polarity |
| 24 | S2- | Current Sink 2, Negative Polarity |

Fig. 6-101: Pin assignment TTY / 20 mA, active

### 6.5.3.2 Pin assignment for operating devices without a universal interface

| Pin | Designation | Function |
|---|---|---|
| 1 | Shield | Shielding |
| 2 | T+ | Transmitted Data, Positive Polarity |
| 3 | S1+ | Power Source 1, Positive Polarity |
| 4 | R+ | Received Data, Positive Polarity |
| 5 | S2+ | Power Source 2, Positive Polarity |
| 6 | T- | Transmitted Data, Negative Polarity |
| 7 | S1- | Current Sink 1, Negative Polarity |
| 8 | R- | Received Data, Negative Polarity |
| 9 | S2- | Current Sink 2, Negative Polarity |

Fig. 6-102: Pin assignment TTY / 20 mA, active

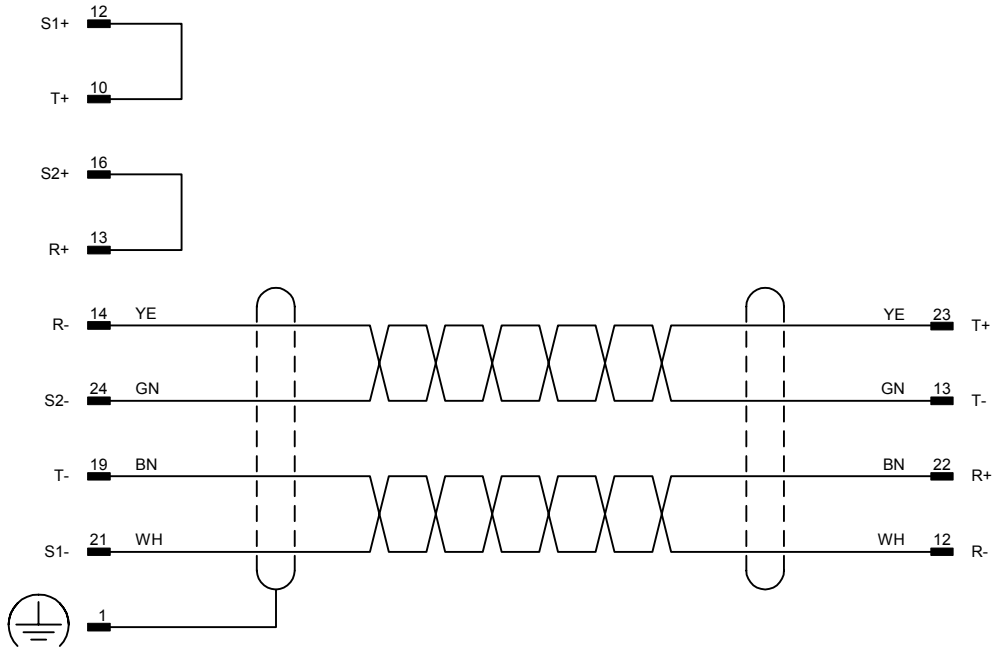
Bosch BUEP19E

## 6.5.3.3 Kabel X3 SER1 TTY / 20 mA - Bosch PG

The following cabling diagram applies to operating devices with a universal interface **only**.

Bediengerät
Sender aktiv
Empfänger aktiv

Bosch
z.B. SK500
Sender passiv
Empfänger passiv




D-SUB
Stiftstecker
25-polig

D-SUB
Stiftstecker
25-polig

Both ends of the shield are connected to the metallic housing.

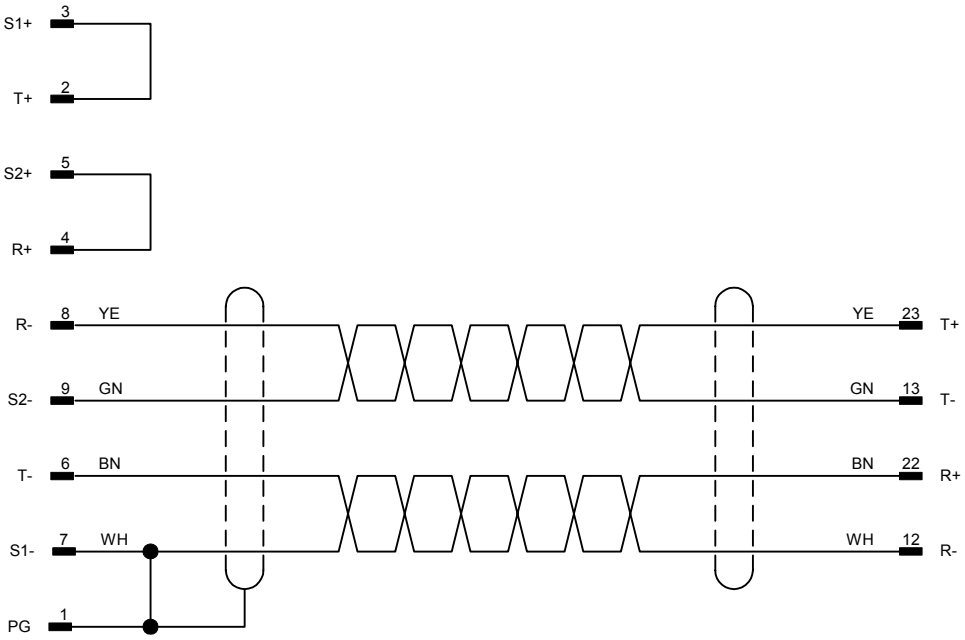
Bosch BUEP19E

## 6.5.3.4 Kabel X2 TTY / 20 mA - Bosch PG

The following cabling diagram does **not** apply to operating devices with a universal interface.

Bediengerät
Sender aktiv
Empfänger aktiv

Bosch
z.B. SK500
Sender passiv
Empfänger pas-
siv




D-SUB
Stiftstecker
9-polig

D-SUB
Stiftstecker
25-polig

Both ends of the shield are connected to the metallic housing.

Bosch BUEP19E

## 6.5.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | 1 | Slave not ready | Wrong baud rate or cable defective |
| | 3 | Error in protocol frame | |
| | 5 | CRC error | |
| | 6 | Wrong parity | |
| | 10 | No cyclic data defined | |
| | 16 | Receive buffer overrun | |
| Bosch-Specific Error Messages | | | |
| 1 | 50 | No connection set-up | |
| | 51 | Wrong acknowledgement during connection set-up | |
| | 52 | Wrong acknowledgement after sending information block | Wrong block check set, PG uses LRC8. The first peripheral participant determines the block check used ! |
| | 53 | No response telegram | |
| | 54 | Timeout - No response telegram | |
| | 55 | Block time exceeded | |
| | 56 | No acknowledgement | |
| | 57 | EOT - Aborted by controller | |
| 2 | 58 | Incorrect number of data received | Check if the mask, in which the error occured, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |

Fig. 6-103: Error Messages for Bosch BUEP19E

Bosch BUEP19E

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| Error from Programmable Controller | | | |
| 3 | 1 | Addressed module does not exist | |
| | 16 | Module cannot be addressed | |
| | 35 | The address field has been protected by the user | |
| | 36 | Access to this address field is not permitted | |
| | 37 | Writing to timer is not allowed | |
| | 38 | Block number too large | |
| | 39 | Block does not exist | |
| | 40 | Block too small | |
| | 147 | Flag area (CL200 only) exceeded | Flag area defined is outside of BYM0 to BYM191 |
| 4 | 32 | Addressed data type (command code) unknown in PST (peripheral station) | |
| | 33 | Protocol code unknown in PST | |
| | 35 | Specified coordination flag unknown in PST | |
| | 37 | Parameter code in telegram and specified parameters do not match | |
| | 38 | Block length and actual number of data do not match | |
| | 40 | Telegram type unknown | |
| | 41 | Command type unknown | |
| | 58 | Starting address and operand type do not match (word at odd address) | Defective R500 module possible |
| | 59 | Starting address outside of specified address range | |
| | 60 | Invalid parameter for specified command | |
| | 61 | Invalid operand type | |
| | 64 | PST has not received an identification telegram | |
| | 99 | Specified data length greater than addressed data area | |
| | 210 | Coordination flag is disabled | |
| Error from Operating Device | | | |
| 40 | | System variable error | Undefined system variable |

Fig. 6-103: Error Messages for Bosch BUEP19E

## 6.6 DeviceNet

The operating device is incorporated into the DeviceNet network as a DeviceNet slave. The communication between a controller (master or scanner) and the operating device (slave) is based on the Predefined Master/Slave Connection Set.

Explicit Message Connections and Poll I/O Connections are used as Connection Instances.

### 6.6.1 Explicit Message

Explicit Messages are used to exchange data between the operating device and the controller. This requires you to create a function block in the controller which assembles the payload into Explicit Messages.

#### 6.6.1.1 Storing Data

All data displayed by the operating device are stored in the operating device's data memory.

The size of the data memory is 2500 words.

The data memory is word-oriented. The addresses are always word addresses, both from the operating device's and the controller's perspective.

#### 6.6.1.2 Exchanging Data

You need to create a program (function block) in the controller which is used to establish a data exchange between the operating device and the controller by means of Explicit Messages. For this, make sure that the data on both devices are consistent.

You can carry out the data exchange cyclically or carry it out event-controlled through the controller using the I/O Poll Telegram.

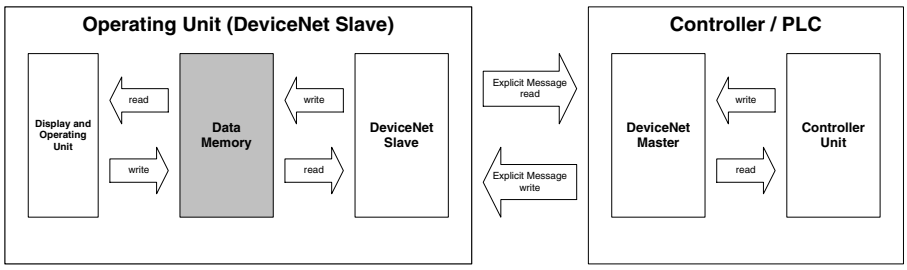



Fig. 6-104: Data exchange, DeviceNet

### 6.6.1.3 Data Memory

The data memory in the operating device is referred to as the Memory Object.

The Memory Object Address has the following values.

| Address | Name | Comment |
|---|---|---|
| 0x8A | Class ID | |
| 0x01 | Instance ID | |
| 0x01 | Attribute | Not required |

Fig. 6-105: Memory object addresses

The service

– for a read access is 0x33 and
– for a write access is 0x35.

### 6.6.1.4 Read Service

The following table illustrates the structure of the Explicit Message for the Read service. Each field of the telegram is one byte long.

| Byte | Request telegram | Response telegram |
|---|---|---|
| 1 | MAC ID | MAC ID |
| 2 | Service ID<br>0x33 | Service ID<br>0xB3 |
| 3 | Class ID<br>0x8A | 1st Data Word<br>Low Byte |
| 4 | Instance ID<br>0x01 | 1st Data Word<br>High Byte |
| 5 | Word Address<br>Low Byte | 2nd Data Word<br>Low Byte |
| 6 | Word Address<br>High Byte | 2nd Data Word<br>High Byte |
| 7 | Number of Bytes<br>Low Byte | |
| 8 | Number of Bytes<br>High Byte | |

Fig. 6-106: Structure of the Explicit Message for the Read service

The word address corresponds to the offset within the data memory in the operating device.

The byte order for the

– word address,
– number of bytes and
– data word

can be specified in the communication parameters.

See chapter „Byte Order“ on page 6-76.

### 6.6.1.5 Write Service

The following table illustrates the structure of the Explicit Message for the Write service. Each field of the telegram is one byte long.

| Byte | Request Telegram | Response Telegram |
|---|---|---|
| 1 | MAC ID | MAC ID |
| 2 | Service ID<br>0x35 | Service ID<br>0xB5 |
| 3 | Class ID<br>0x8A | |
| 4 | Instance ID<br>0x01 | |
| 5 | Word Address<br>Low Byte | |
| 6 | Word Address<br>High Byte | |
| 7 | 1st Data Word<br>Low Byte | |
| 8 | 1st Data Word<br>High Byte | |
| 9 | 2nd Data Word<br>Low Byte | |
| 10 | 2nd Data Word<br>High Byte | |

Fig. 6-107: Structure of the Explicit Message for the Write service

The word address corresponds to the offset within the data memory in the operating device.

The byte order for the

– word address,
– number of bytes and
– data word

can be specified in the communication parameters.

See chapter „Byte Order“ on page 6-76.

### 6.6.1.6 Fragmentation

By means of fragmentation, up to 384 bytes can be transferred in one explicit message.

## 6.6.2 Poll I/O Connection

The Poll I/O Connection can be used for event-controlled exchange of data between the master and the slave.

On account of the EDS data, the Poll I/O Connection is installed automatically between the DeviceNet master and the operating device. With this connection, 2 bytes are transferred cyclically from the controller's OUT area to the operating device and 5 bytes are transferred from the operating device to the IN area of the controller.

### 6.6.2.1 Receive Data of the Operating Device (Consumed Data)

The Consumed Connection Size is 2 bytes.

| Byte | Designation |
|---|---|
| 1 | Initialization |
| 2 | Control Byte |

Fig. 6-108: Structure of the Consumed Data

### 6.6.2.2 Transmit Data of the Operating Device (Produced Data)

The Produced Connection size is 5 bytes.

| Byte | Designation |
|---|---|
| 1 | Initialization |
| 2 | Control Byte |
| 3 | Word Address - Low Byte |
| 4 | Word Address - High Byte |
| 5 | Number of Altered Bytes |

Fig. 6-109: Structure of the Produced Data

## Byte 1 - Initialization

During the boot process, the operating device writes the value 0x00 into its Produced Data. Thus, the controller needs to initialize the entire data memory in the operating device once.

Initialization means that all variable values in the data memory of the operating device are set the same as in the controller. When this process is completed, the controller writes the value 0xC3 into the Consumed Data.

The operating device acknowledges by writing the value 0xC3 into the Produced Data.

After the boot process, the operating device waits for the initialization to complete, before it accesses the data memory. If the initialization is not performed within the time period set for the Delay until Connection Set-Up, the message WAIT FOR INITIZING OF DATA-MEMORY BY MASTER is displayed on the operating device.

To remove the message, press the Help key or a key that calls up another mask.

## Byte 2 - Control Byte

During initialization, the control byte is set to the value 0x00.

**Bit 0**

Bit 0 is the toggle bit.

After you change a variable on the operating device, bit 0 in the Produced Data toggles.

If the controller detects that bit 0 in the Produced Data and bit 0 in the Consumed Data do not match, the controller reads the variable.

Once the read operation is complete, the controller sets the value of

bit 0 in the Consumed Data to the same value as that of bit 0 in the Produced Data.

If the controller detects that bit 0 in the Produced Data and bit 0 in the Consumed Data differ, bit 0 in the Consumed Data must be set to the same value as that of bit 0 in the Produced Data!
This also applies if cyclic data exchange is used.

If no bit synchronization takes place, the operating device displays the error message Timeout Error: Code 60, Subcode1“.

**Bit 1 to bit 7** Bits 1 to 7 are reserved.

### Byte 3 and Byte 4 - Word Address

Bytes 3 and 4 in the Produced Data contain the word address starting from which a variable has changed. The variable can be several bytes long. The controller uses this word address to selectively read the changed variable from the data memory of the operating device.

### Byte 5 - Number of Bytes

Byte 5 in the Produced Data contains the number of bytes as the size information for the changed variable.

## 6.6.2.3 Module /Network Status

The operating devices are not equipped with diagnostic LEDs for DeviceNet status indication.

To indicate the module/network status, use the system variable ComBaudrateA instead.

See chapter „ComBaudrateA“ on page 5-49.

DeviceNet

## 6.6.3 Programming

### 6.6.3.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### Baud Rate

This parameter specifies the communication rate.

| Configurable Values (kBaud) | Default Value |
|---|---|
| 125 | X |
| 250 | |
| 500 | |

Fig. 6-110: Baud rate, DeviceNet

#### Node Number

Use the node number to set the MAC ID for the operating device.

| Configurable Values | Default Value |
|---|---|
| 0 to 63 | 0 |

Fig. 6-111: Node number, DeviceNet

#### Delay until Connection Set-Up

Specify this value to set the period of time the operating device waits before it sends the first Duplicate MAC ID Check Request Message. Messages arriving before this time has elapsed are not evaluated.

| Configurable Values | Default Value |
|---|---|
| 5 s to 255 s | 5 s |

Fig. 6-112: Delay until connection set-up, DeviceNet

## Waiting Time for Response

Specify a waiting time for the Produced Data toggle bit monitoring.

| Configurable Values | Default Value |
|---|---|
| 0 ms, 50 ms to 65000 ms | 500 ms |

Fig. 6-113: Waiting time for response, DeviceNet

See chapter „Byte 2 - Control Byte“ on page 6-73.

## Attribute

The Attribute parameter is not required in the Explicit Message to access the Memory Object. Some controllers do, however, force and transfer the Attribute parameter to generate an Explicit Message.

In this case, select the check box: Explicit Message Contains the Parameter 'Attribute'.

| Configurable Values | Default Value |
|---|---|
| OFF | |
| ON | X |

Fig. 6-114: Explicit Message contains the Attribute parameter, DeviceNet

## Byte Order

The byte order for the DeviceNet protocol is Low-High.

See Appendix J in Volume 1 of the DeviceNet Specification.

The experience of some users has shown that some controllers do not use this byte order. In these cases, a byte-swap must be performed in the controller. For ease of programming, the user also has the option of swapping the byte order in the operating device.

Select two selection fields depending on the actual byte order:

| Configurable Values | Default Value |
|---|---|
| Address/Length Low-High | X |
| Data Low-High | X |
| Address/Length High-Low | |
| Data High-Low | |

Fig. 6-115: Byte order

### 6.6.3.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

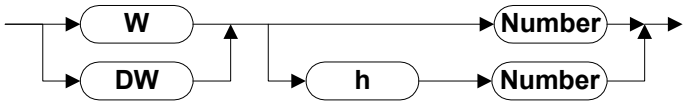



Fig. 6-116: Syntax diagram for DeviceNet

### 6.6.3.3 Variables

The variable addresses specify an offset in the data memory of the operating device.

| Variable name | Address | Low Byte | High Byte |
|---|---|---|---|
| Word Access to Address 127 | W 127 | | |
| Word Access to the Highest Address | W 2500 | | |
| Double-Word Access to Address 371 | DW 371 | | |
| Double-Word Access to the Highest Address | DW 2499 | | |
| Bit Access to Bit 5 in Address 500 | W 500 | 5 | 5 |
| Bit Field Access to Bit 3 - Bit 12 in Address 1500 | W 1500 | 3 | 12 |

Fig. 6-117: Addresses in the data memory of the operating device

## 6.6.3.4 System Variables

Since the operating devices do not have diagnostic LEDs, you need to use system variables to indicate specific DeviceNet statuses. You can create these system variables within any mask as output variables. To do so, select the representation type Selection Text and link the variable with a text list containing a text string for each status.

### ComBaudrateA

This system variable can be used to indicate the statuses of the module/network LED.

| Value | Text | Meaning |
|---|---|---|
| 0 | LED Off | |
| 1 | LED Green | Device is assigned |
| 2 | LED flashes green | DUP_MAC_ID test is OK but a connection has not been established |
| 3 | LED Flashes Red | Connection terminated after a time delay |
| 4 | LED Red | BUS-OFF status |
| 5 | LED flashes red and green | DUP_MAC_ID error |

Fig. 6-118: Statuses of the module/network LED

### ComHandshakeA

This system variable allows you to indicate whether the data memory has been initialized by the master.

See chapter „Byte 1 - Initialization“ on page 6-73.

| Value | Status |
|---|---|
| 0 | Not initialized |
| 1 | Initialized |

Fig. 6-119: Initialization states of the data memory

DeviceNet

## 6.6.4 Object Definitions

| Class ID | Object Name |
|---|---|
| 0x01 | Identity Object |
| 0x02 | Message Router (not supported) |
| 0x03 | DeviceNet Object |
| 0x04 | Assembly Object (not supported) |
| 0x05 | Connection Object |
| 0x8A | BT Object |

Fig. 6-120: Object definitions

### 6.6.4.1 Identity Object

#### Instance Attribute

| Attribute ID | Attribute Name | Access Rule | Data Size (Byte) | Attribute Value |
|---|---|---|---|---|
| 0x01 | Vendor ID | Get | 2 (6-2.2) | 0x238 |
| 0x02 | Device Type | Get | 2 | 0x00 |
| 0x03 | Product Code | Get | 2 | 0x01 |
| 0x04 | Revision | Get | 2 | 0x0101 (1.001) |
| 0x05 | Status | Get | 2 | |
| 0x06 | Serial Number | Get | 4 | 0x01 |
| 0x07 | Product Name | Get | 32 | DeviceNet for BT series |

Fig. 6-121: Instance Attribute of the Identity Object

#### Instance Service

| Service ID | Service Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Returns the Contents of the Specific Attribute |
| 0x05 | Reset | Invoke the Reset Service in the BT |

Fig. 6-122: Instance Service of the Identity Object

#### Message Router Object

This object is not supported.

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### 6.6.4.2 DeviceNet Object

#### Class Service

| Service ID | Service Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read Attribute |

Fig. 6-123: Class Service of the DeviceNet Object

#### Instance Attribute

| Attribute ID | Attribute Name | Access Rule | Data Size (Byte) |
|---|---|---|---|
| 0x01 | MAC ID | Get | 1 |
| 0x02 | BaudRate | Get | 1 |

Fig. 6-124: Instance Attribute of the DeviceNet Object

#### Instance Service

| Service ID | Service Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Returns the Contents of the Specific Attribute |
| 0x05 | Reset | Invoke the Reset Service in the BT |

Fig. 6-125: Instance Service of the Identity Object

### 6.6.4.3 Assembly Object

This object is not supported.

### 6.6.4.4 Connection Object

#### Class Service

| Service ID | Service Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read Attribute |

Fig. 6-126: Class Service of the Connection Object

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## Instance Attribute

| Attribute ID | Attribute Name | Access Rule | Data Size (Byte) | Value Expl. | Value IO-Poll |
|---|---|---|---|---|---|
| 0x01 | State | Get | 1 | 3 | 1 |
| 0x02 | Instance Type | Get | 1 | 0 | 1 |
| 0x03 | TransportClass_Trigger | Get | 1 | 0x38 | 0x82 |
| 0x04 | Produced Connection ID | Get | 2 | | |
| 0x05 | Consumer Connection ID | Get | 2 | | |
| 0x06 | Initial Comm Characteristics | Get | 1 | 0x21 | 0x01 |
| 0x07 | Produced Connection Size | Get | 2 | | 5 |
| 0x08 | Consumed Connection Size | Get | 2 | | 2 |
| 0x09 | Expected Packed Rate | Get/Set | 2 | 0x9C4 | 0 |
| 0x0C | Watchdog TimeoutAction | Get | 1 | 3 | 0 |
| 0x0D | Produced Connection Path Length | Get | 2 | 0 | 0 |
| 0x0E | Produced Connection Length | Get | 6 | | |
| 0x0F | Consumed Connection Path Length | Get | 2 | 0 | 0 |
| 0x10 | Consumed Connection Path | Get | 6 | | 0 |

Fig. 6-127: Instance Attribute of the Connection Object

## Instance Service

| Service ID | Service Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read Attribute |
| 0x10 | Set_Attribute_Single | Write Attribute |

Fig. 6-128: Instance Service of the Connection Object

## BT Object

## Instance Service

| Service ID | Service Name | Description |
|---|---|---|
| 0x33 | Block StringN Read | Read Data by Each Data Unit |
| 0x35 | Block StringN Write | Write Data by Each Data Unit |

Fig. 6-129: Instance Service of the BT Object

DeviceNet

**Service ID = 0x33 (Block StringN Read)**

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0x33) |
| 3 | Class ID (0x8A) |
| 4 | Instance ID (0x01) |
| 5 | Word Address Low Byte * |
| 6 | Word Address High Byte * |
| 7 | Word Number of Bytes Low Byte * |
| 8 | Word Number of Bytes High Byte * |

Fig. 6-130: Request without Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0xB3) |
| 3 | 1st Data Word Low Byte ** |
| 4 | 1st Data Word High Byte ** |
| 5 | 2. Data Word Low Byte ** |
| 6 | 2nd Data Word High Byte ** |

Fig. 6-131: Response without Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0x33) |
| 3 | Class ID (0x8A) |
| 4 | Instance ID (0x01) |
| 5 | Attribute (0x01) |
| 6 | Word Address Low Byte * |
| 7 | Word Address High Byte * |
| 8 | Word Number of Bytes Low Byte * |
| 9 | Word Number of Bytes High Byte * |

Fig. 6-132: Request with Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0xB3) |
| 3 | 1st Data Word Low Byte ** |
| 4 | 1st Data Word High Byte ** |
| 5 | 2nd Data Word Low Byte ** |
| 6 | 2nd Data Word High Byte ** |

Fig. 6-133: Response with Attribute parameter

**Service ID = 0x35 (Block StringN Write)**

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0x35) |
| 3 | Class ID (0x8A) |
| 4 | Instance ID (0x01) |
| 5 | Word Address Low Byte * |
| 6 | Word Address High Byte * |
| 7 | 1st Data Word Low Byte ** |
| 8 | 1st Data Word High Byte ** |
| 9 | 2nd Data Word Low Byte ** |
| 10 | 2nd Data Word High Byte ** |

Fig. 6-134: Request without Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0xB5) |

Fig. 6-135: Response without Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0x35) |
| 3 | Class ID (0x8A) |
| 4 | Instance ID (0x01) |
| 5 | Attribute (0x01) |
| 6 | Word Address Low Byte * |

Fig. 6-136: Request with Attribute parameter

| Byte | Designation |
|---|---|
| 7 | Word Address High Byte * |
| 8 | 1st Data Word Low Byte ** |
| 9 | 1. Data Word High Byte ** |
| 10 | 2nd Data Word Low Byte ** |
| 11 | 2. Data Word High Byte ** |

Fig. 6-136: Request with Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0xB5) |

Fig. 6-137: Response with Attribute parameter

* Depends on the protocol parameter Byte Order for Address/Length.

** Depends on the protocol parameter Byte Order for Data.

See chapter „Byte Order“ on page 6-76.

## 6.6.5 Format of the Explicit Message High Byte

| Class ID (1 Byte) | Service ID (1 Byte) | Instance ID (1 Byte) | Service Data | | Service Name |
|---|---|---|---|---|---|
| | | | Attribute ID (1 Byte) | Data (n Byte) | |
| 0x01 (Identity Object) | | 0x01 | 0x01 | Vendor ID | Get Attribute SingleVendor ID |
| | | | 0x02 | Product Type | Get Attribute SingleProduct Type |
| | | | 0x03 | Product Code | Get Attribute SingleProduct Code |
| | | | 0x04 | VendorRevision | Get Attribute SingleVendor Revision |
| | | | 0x05 | ID Status | Get Attribute SingleID Status |
| | | | 0x06 | Serial Number | Get Attribute SingleSerial Number |
| | | | 0x07 | Product Name | Get Attribute SingleProduct Name |
| | 0x05 | | N/A or 0x01 | | RESET |
| 0x03 (DeviceNet Object) | 0x0E (Get) | 0x01 | 0x01 | MAC ID | Get Attribute Single MAC ID |
| | | | 0x02 | Baud Rate | Get Attribute SingleBaud Rate |
| | | | 0x03 | BOI | Get Attribute Single BOI |
| | | | 0x04 | Bus Off Counter | Get Attribute SingleBus Off Counter |
| | | | 0x05 | AllocationInformation | Get Attribute SingleAllocation Information |

Fig. 6-138: Format of the Explicit Message

| **Class ID (1 Byte)** | **Service ID (1 Byte)** | **Instance ID (1 Byte)** | **Service Data** | | **Service Name** |
|---|---|---|---|---|---|
| | | | **Attribute ID (1 Byte)** | **Data (n Byte)** | |
| 0x05 (Connection Object) | 0x0E (Get) | 0x01 (Explicit Message)<br>0x02 (Polled I/O)<br>0x03 (Bit Strobed I/O) | 0x01 | State | Get Attribute Single State |
| | 0x02 | Instance Type | Get Attribute SingleInstance Type | | |
| | 0x03 | Transport Class Trigger | Get Attribute SingleTransport Class Trigger | | |
| | 0x04 | Produced Connection ID | Get Attribute SingleProduced Connection ID | | |
| | 0x05 | Consumed Connection ID | Get Attribute SingleConsumed Connection ID | | |
| | 0x06 | Initial Comm. Characteristics | Get Attribute Single Initial Comm. Characteristics | | |
| | 0x07 | Produced Connection Size | Get Attribute SingleProduced Connection Size | | |
| | 0x08 | Consumed Connection Size | Get Attribute SingleConsumed Connection Size | | |
| | 0x09 | Expected Packet Rate | Get Attribute SingleExpected Packet Rate | | |
| | 0x0C | Watchdog TimeoutAction | Get Attribute SingleWatchdog Timeout Action | | |
| | 0x0D | Produced Connection Path Length | Get Attribute SingleProduced Connection Path Length | | |

DeviceNet

| Class ID (1 Byte) | Service ID (1 Byte) | Instance ID (1 Byte) | Service Data | | Service Name |
|---|---|---|---|---|---|
| | | | Attribute ID (1 Byte) | Data (n Byte) | |
| 0x8A (Memory Object) | 0x33 (Read) | 0x01 | 0x01 | Service Data | Block String Read |
| | 0x35 (Write) | 0x01 | 0x01 | Service Data | Block String Write |

Fig. 6-138: Format of the Explicit Message

## 6.6.6 EDS File

The EDS file ensures that the Poll I/O Connection is automatically installed between the DeviceNet master and operating device.

## 6.6.7 Physical Interfacing

Plug-in connectors on the operating device for connection to the DeviceNet bus.

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | CAN_L | CAN_L Bus Line (Dominant LOW) |
| 3 | CAN_GND | CAN Ground |
| 4 | nc | Not Connected |
| 5 | nc | Not Connected |
| 6 | CAN_GND | CAN Ground |
| 7 | CAN_H | CAN_H Bus Line (Dominant HIGH) |
| 8 | nc | Not Connected |
| 9 | nc | Not Connected |

Fig. 6-139: Pin assignment X2.1 / X2.2 CAN bus

For the connection to the bus, use twisted pair, shielded cables only. Terminate both ends of the bus with terminating resistors.

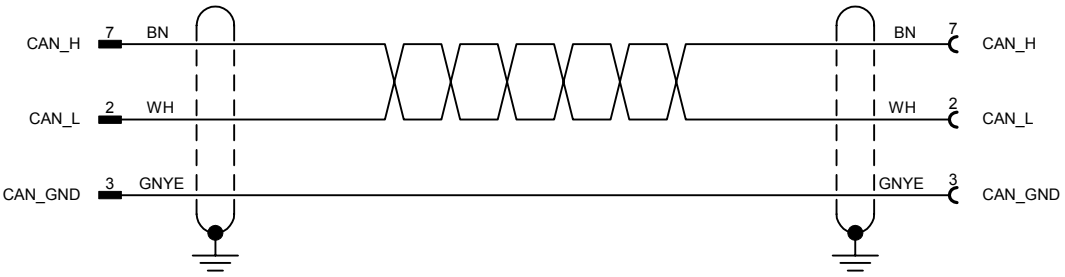
All signal lines in the operating device are bridged from X2.1 to X2.2. Connect the connecting cables to all pins, including the reserved pins. This allows continued use of the cables, even if the bus specification is extended in the future.

DeviceNet

## 6.6.7.1 Cable X2.1 / X2.2 - DeviceNet

Operating device

Next DeviceNet participant




D-SUB
male connector
9 pin

D-SUB
female connector
9 pin

Both ends of the shield are connected to the metallic housing.

Contrary to the recommendations made in the CiA Draft Standard 102, the cable is only equipped with the wires needed to meet the current communication requirements.

## 6.6.8 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | | Hardware error | |
| | 1 | CAN controller error (stuff error) | |
| | 2 | CAN controller error (form error) | |
| | 3 | CAN controller error (acknowledge error) | Device is not connected to the bus. |
| | 4 | CAN controller error (bit 1 Error) | Short-circuit between the CAN_L and CAN_H line. |
| | 5 | CAN controller error (bit 0 error) | Short-circuit between the CAN_L and CAN_H line. |
| | 6 | Error from CAN controller (CRC error) | |
| 60 | | Data exchange error | |
| | 1 | Toggle bit in the control byte is not processed by the controller or the DeviceNet master. | If the controller detects that the toggle bit in the Produced Data and the toggle bit in the Consumed Data differ, the toggle bit in the Consumed Data must be set to the same value as that of the toggle bit in the Produced Data. |

Fig. 6-140: DeviceNet error messages

DeviceNet

## 6.6.9 Applications

### 6.6.9.1 Rexroth PPC

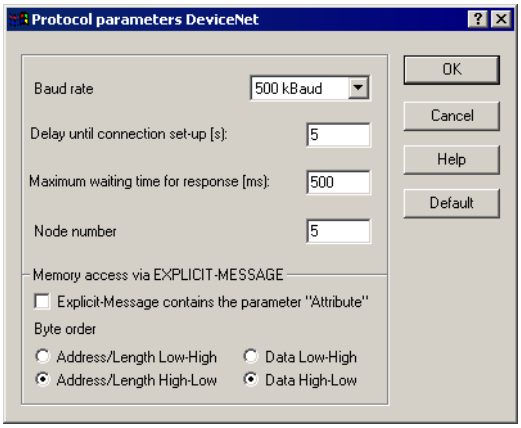



Fig. 6-141: Protocol parameters for Rexroth PPC

## 6.7 DIN Measurement Bus

You can connect a small operator terminal as a slave to a controller and then use this device as a gateway for other slaves in a DIN Measurement Bus.

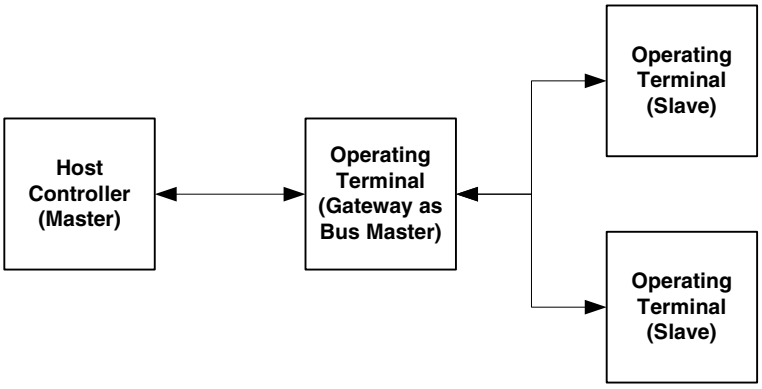



Fig. 6-142: DIN Measurement Bus structure

When the operating device is connected to the controller (host computer) this is usually a point-to-point connection. In this case, the controller is the master and the operating device is the slave.

The small operator terminal in turn acts as the gateway and bus master in the DIN Measurement Bus. You can connect additional small operator terminals as slaves to this operating device.

A detailed description of the connection between the host computer and gateway is provided for each type of connection.

The firmware used in the small operator terminal that operates as the DIN Measurement Bus master differs from the firmware used in the connected small operator terminals functioning as slaves.

### 6.7.1 DIN Measurement Bus Master

Any process computer can be used as a DIN Measurement Bus master, provided that it complies with the following requirements:

– Communication takes place according to DIN66348 part 2 (specifies data link layers 1 and 2 of the ISO/OSI layer model).
– Data contents interpreted as per specifications.

The services (DIN Measurement Bus user data contents) are defined independently of addresses. A number of different address formats is provided for the connection. An internal address format is used for indirect PLC connections. Linear, byte-oriented memory addressing with an address space of 224 bits is used for general process computer connections.

If you choose to use a small operator terminal as a bus master, it offers the full range of functions of a small operator terminal that manages

connection to the controller using interface X2 and handles the DIN Measurement Bus protocol using interface X3.

This small operator terminal therefore does not feature the following functions:

– Printout of messages, logs and so on
– Barcode scanner connection

When used as a gateway, the small operator terminal has the following additional functions not included with the standard small operator terminal:

– Extended poll area
– Cache function for read-only data
– Network status image.

### 6.7.1.1 Extended Poll Area

With the cyclic poll area, you can access the following functions on the master or slave operating device:

– Write coordination byte (WCB)
– Serial message channel
– Status LEDs for function keys

The function has been enhanced to offer more than the standard poll area for direct PLC connection. Rather than being statically mapped to the operating device functions, this poll area is event-controlled and transmitted for each specific slave by means of the trigger byte. In other words, the controller fills the poll area and then transfers it to the gateway using bit 7 (value 0x80) of the trigger byte. Once the function has been executed, the gateway writes the return value and the code 0x40 into the trigger byte. The controller then resumes control of the data area.

The poll area has the following set layout, which may be either byte-oriented or word-oriented, depending on the address specified:

DIN Measurement Bus

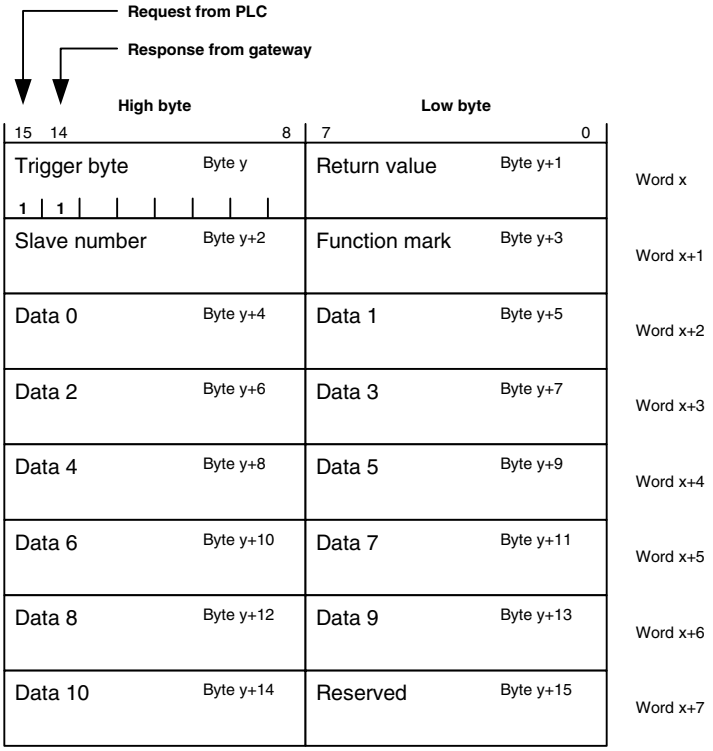



Fig. 6-143: Structure of poll area for DIN Measurement Bus

| Byte | Bit | Function |
|---|---|---|
| Slave Number | 0 | Data are intended for the gateway itself |
| | 1 to 31 | Slave number to which the event is transmitted by order-only |
| Function Code | 1 | Transfer new Write co-ordination byte |
| | 2 | Transmit message |
| | 3 | Activate/deactivate LEDs |
| Return Value | 0 | Ok-acknowledge signal |
| | 1 | Slave is not ready to receive |
| | 2 | General DIN Measurement Bus error |
| | 3 | Invalid function code |
| | 4 | Slave not synchronized |
| Function "Transmit new Write coordination byte (WCB)" | | |
| Data 0 | | WCB (Write coordination byte) |
| Data 1 | | Available |
| Function "Transmit message" | | |
| Data 0 | | Message number high byte |
| Data 1 | | Message number low byte |

Fig. 6-144: Function of the individual bytes

| Byte | Bit | Function |
|---|---|---|
| Function "Activate/deactivate LEDs" | | |
| Data 0 | | LED 1 to LED 4 |
| Data 1 | | LED 5 to LED 8 |
| Data 2 | | LED 9 to LED 12 |
| Data 3 | | LED 13 to LED 16 |
| Data 4 | | LED 17 to LED 20 |
| Data 5 | | LED 21 to LED 24 |
| Data 6 | | LED 25 to LED 28 |
| Data 7 | | LED 29 to LED 32 |
| Data 8 | | LED 33 to LED 36 |
| Data 9 | | LED 37 to LED 40 |
| Data 10 | | LED 41 to LED 44 |

Fig. 6-144: Function of the individual bytes

### 6.7.1.2 Cache Function for Read-Only Data

The cache function reads a memory area of up to 62 bytes from the PLC and broadcasts the information to all connected slaves at cyclic intervals. This greatly reduces the load on the bus and allows simultaneous transmission of the data to all operating devices.

The broadcast service on communication layer 2 is not monitored, therefore, the slaves implement a definable timeout to monitor receipt of the broadcasted data packets.

If a slave has a read request which is located within the cache area, no communication will be carried out via the gateway to the PLC, but the data will be copied locally from the cache of the gateway operating device.

Variables that are displayed once and which are located within the cache area, will be displayed once more after receipt of the next cache packet. The gateway operating device transmits the cache data in an equidistant fashion thus permitting a high-priority and speedy output which is independent of the general output cycle.

### 6.7.1.3 Network Status

A 4-byte area is used by the gateway to transmit the status of the network to the PLC. Each slave which is detected on the network and

which is synchronized is represented by a bit set to "1".

If a slave is being synchronized (i.e. its bit changes from "0" to "1"), the external data release for this slave will be reset and the function keys for this slave will be inactive (the write coordination byte assumes the value "0"). In such an event, the controller might have to return the operating device to the appropriate state via the poll area!

The 4-byte area is either byte-oriented or word-oriented, depending on the address.

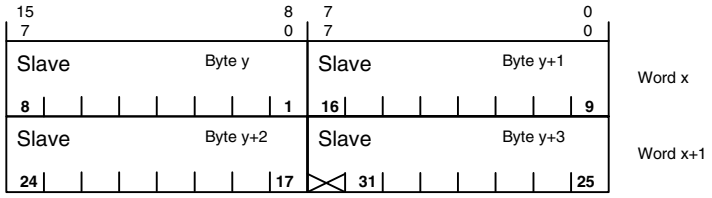



Fig. 6-145: Structure of the 4-byte area for the network status

## 6.7.2 Programming

### 6.7.2.1 Protocol Parameters for the PLC Connection

The protocol parameters for the PLC connection are the same as the procotol parameters for the standard connection to the relevant controller.

### 6.7.2.2 Protocol Parameters for the DIN Measurement Bus Master

You can use the protocol parameters to influence the communication between the operating device and the controller. All parameters are set to the default values which ensure a reliable communication.

#### Baud Rate

This parameter specifies the communication rate.

| Configurable Values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |

Fig. 6-146: Baud rate, DIN Measurement Bus master

| Configurable Values (Baud) | Default Value |
|---|---|
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

Fig. 6-146: Baud rate, DIN Measurement Bus master

## Parity

This parameter specifies the parity used to control the communication.

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

Fig. 6-147: Parity, DIN Measurement Bus master

## Handshake

This parameter specifies the method used to control the communication.

| Configurable Values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

Fig. 6-148: Handshake, DIN Measurement Bus master

## Data Bits

This parameter specifies the number of data bits.

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | X |
| 8 | |

Fig. 6-149: Data bits, DIN Measurement Bus master

## Stop Bits

This parameter specifies the number of the stop bits.

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

Fig. 6-150: Stop bits, DIN Measurement Bus master

## Slave Number

You can enter the slave number for the relevant slave terminal here. To load the same project on all slave terminals, you can set an invalid slave number here. You must then use the system variable ComSlaveNr. in the setup mask during runtime to set a correct slave number. Any invalid values are set to the value 255 (0xFF) when the operating device is started up.

| Configurable Values | Default Value |
|---|---|
| 1 to 31 | 0 |

Fig. 6-151: Slave number, DIN Measurement Bus master

## 6.7.3 Additional Error Messages

In addition to the "normal" error messages for this connection, the gateway operating device displays error messages associated with its use as a gateway. The subcode of these error messages always indicates the error numbers of the respective communication protocol.

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

| Code | Subcode | Error Tzpe | Possible Cause |
|---|---|---|---|
| 41 | | Error reading the cache from the controller | |
| 42 | | Error reading the gateway poll area | |
| 43 | | Error writing the gateway poll area | |
| 44 | | Wrong address syntax | One of the slave terminals contains a variable with an address syntax which is not compatible with the protocol of the gateway |
| 45 | | Error writing the network status to the controller | |
| 46 | | No gateway parameters | |

Fig. 6-152: Additional error messages, DIN Measurement Bus

## 6.7.4 DIN Measurement Bus Slave

You can operate up to 30 slave terminals simultaneously on one DIN Measurement Bus. The slave terminals access the data of the bus master. All of the slave terminals function in the same way as when directly connected to a controller. You only have to adjust the interface parameters to the DIN Measurement Bus.

The bus master (process computer or gateway to PLC) and slave are connected via the DIN Measurement Bus, as specified in DIN 66348.

The services required for data exchange (user data of the DIN Measurement Bus protocol) are defined in an own specification.

To reduce the workload on the bus, each slave terminal may have its own read-only data cache. The address location and length of the cache are negotiated during synchronization between the bus master and slave terminal. The bus master performs an equidistant transfer of the cache data by broadcasting them to all slave terminals and each slave terminal then saves this data locally.

If a slave terminal has a read request that is located within this cache area, no communication process takes place via the gateway to the PLC. Instead, the data is copied locally from the terminal cache.

Variables that are output just once and are contained within the cache area are output again once the next cache package is received. Since the gateway performs an equidistant transfer of cache data, this means that a rapid output with higher priority can be executed (independently of the general output cycle).

## 6.7.5 Programming

### 6.7.5.1 Protocol Parameters for the DIN Measurement Bus Slave

You can use the protocol parameters to influence the communication between the operating device and the controller. All parameters are set to the default values which ensure a reliable communication.

## Baud Rate

This parameter specifies the communication rate. You must specify the same baud rate for the gateway and the slave.

| Configurable Values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | X |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

Fig. 6-153: Baud rate, DIN Measurement Bus slave

## Parity

This parameter specifies the parity used to control the communication.

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

Fig. 6-154: Parity, DIN Measurement Bus slave

## Handshake

This parameter specifies the method used to control the communication.

| Configurable Values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

Fig. 6-155: Handshake, DIN Measurement Bus slave

## Data Bits

This parameter specifies the number of data bits.

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | X |
| 8 | |

Fig. 6-156: Data bits, DIN Measurement Bus slave

## Stop Bits

This parameter specifies the number of the stop bits.

| Configurable Values | Default Value |
|---|---|
| 1 | |
| 1.5 | X |
| 2 | |

Fig. 6-157: Stop bits, DIN Measurement Bus slave

## Timeout for Order Reply

The slave starts a timer whenever data is required from the controller. This timer checks whether or not the slave terminal has been polled by the master and whether a reply from the bus master has been received during this period. If not using timeout monitoring, you must enter the value 0. The absolute timer value depends on the numbers of stations on the network. But it should be roughly between 2,000 and 5,000 milliseconds.

| Configurable Values | Default Value |
|---|---|
| 0 ms to 65000 ms | 2000 ms |

Fig. 6-158: Timeout for order reply, DIN Measurement Bus slave

## Timeout for Cache Update

Since the receiver cannot acknowledge the broadcast service, the slave terminal uses a timeout to monitor the exact time when broadcast data was received. This ensures that the local cache data is not from any "random time in the past". The value of this timeout depends on the cache update time of the bus master (see gateway parameters).

| Configurable Values | Default Value |
|---|---|
| 0 ms to 65000 ms | 10000 ms |

Fig. 6-159: Timeout for cache update, DIN Measurement Bus slave

## Slave Number

This parameter specifies the slave number for the relevant slave terminal. To be able to load the same mask definition into all slave terminals, you can enter an invalid slave number here. You must then use the system variable ComSlaveNr. in the setup mask during runtime to set a correct slave number. Any invalid values will be set to the value 255 (OxFF) at terminal startup.

| Configurable Values | Default Value |
|---|---|
| 1 to 31ms | 0 |

Fig. 6-160: Slave number, DIN Measurement Bus slave

DIN Measurement Bus

## 6.7.6 Physical Interfacing

Plug-in connections on the operating device for connection to the DIN Measurement Bus master or Gateway.

### 6.7.6.1 Pin assignment for operating devices with a universal interface

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

Fig. 6-161: Pin assignment RS485

### 6.7.6.2 Pin assignment for operating devices without a universal interface

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

Fig. 6-162: Pin assignment X2 RS485

## 6.7.6.3 Cable X3 SER1 RS485 - Master/Slave

The following cabling diagram applies to operating devices with a universal interface **only**.

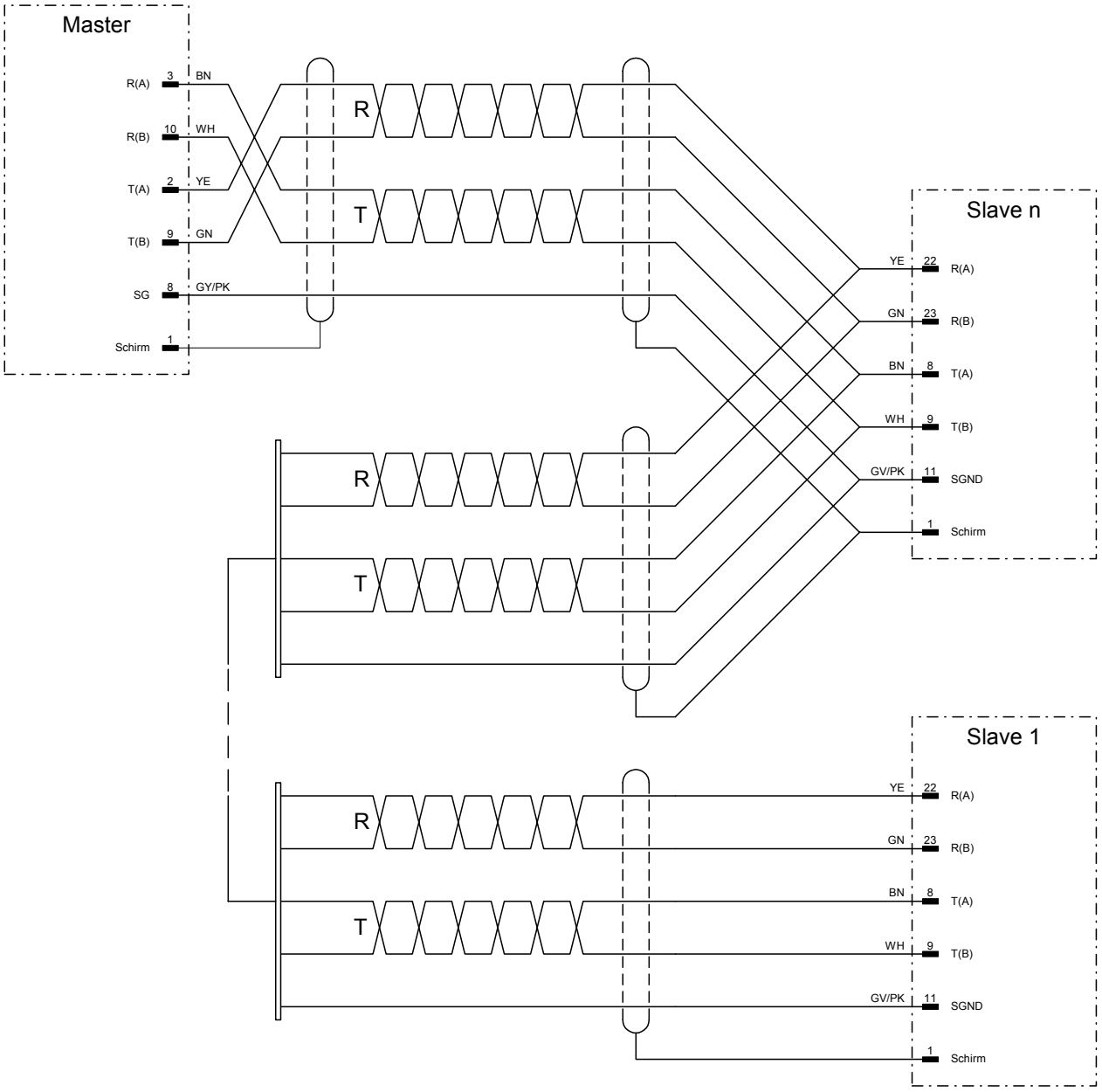



Fig. 6-163: Cable X3 SER1 RS485 - master/slave

DIN Measurement Bus

## 6.7.6.4 Cable X2 RS485 - Master/Slave

The following cabling diagram does **not** apply to operating devices with a universal interface.

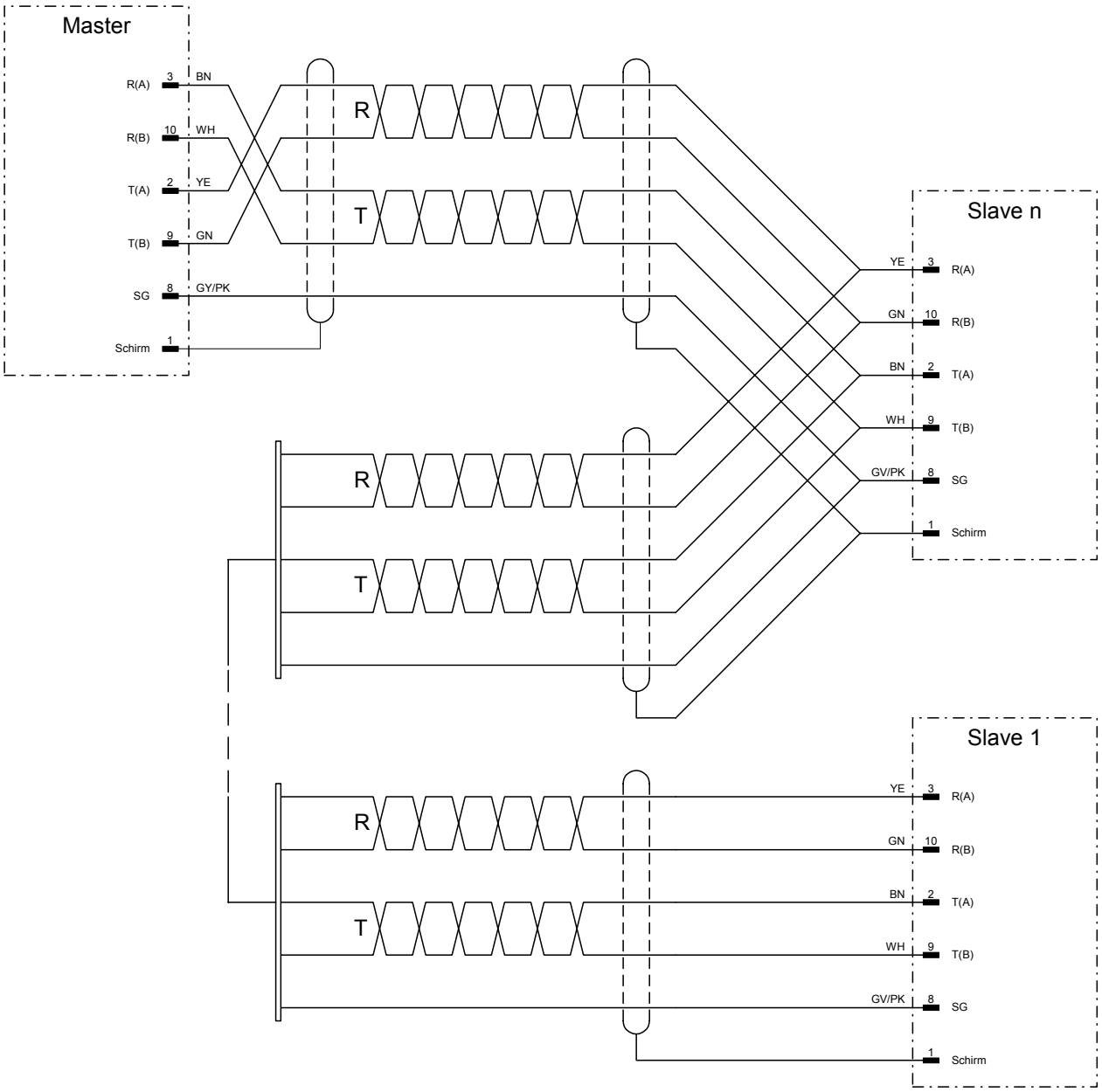



Fig. 6-164: Cable X2 RS485 - master/slave

## 6.7.7 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 30 | | Slave is unable to send transmission data to master | |
| 31 | | Slave is unable to send transmission data to master (timeout) | |
| 32 | | Slave was unable to transmit its order within the timeout | |
| 33 | | Waiting time for receiving the order reply elapsed | |
| 34 | | Slave unable to receive the cache broadcast data within the timeout | |

Fig. 6-165: Error messages, DIN Measurement Bus

# 6.8 INTERBUS MMICOM raw

## 6.8.1 Integration of the Operating Devices

INTERBUS is an open field bus concept that is supported by a number of manufacturers of sensor technology and actuator devices. This means that, in addition to using the same bus to connect to the operating devices, several other participants can be connected to the controller (for example, decentralized inputs and outputs).

The operating device is integrated as a slave in the 2-wire remote bus. In this context, the operating device occupies a data width of 4 words or 8 bytes on the INTERBUS. The controller maps each operating device with 8 bytes IN data and 8 bytes OUT data in the memory map.

If the Physical Addressing operating mode is selected in the controller board, the participants' input and output areas are placed sequentially in the memory of the controller in the same order that they are physically installed in the bus.

If the Logical Address operating mode is selected in the controller board, the location of the input and output areas can be placed freely in the controller memory. The location of these areas is also independent of the sequence of bus participants.

## 6.8.2 MMICOM Profile

The MMICOM profile distinguishes between the following three basic data channels on the INTERBUS:

1. Direct process data channel
2. Indirect process data channel
3. Parameter channel.

### 6.8.2.1 Direct Process Data Channel

Direct process data is cyclical data that remains constant while the device is in operation. They are not acknowledged and are incorporated cyclically into the process data channel (for example, 16 inputs of an input module or bit information of a key field - device class A1 or B1).

### 6.8.2.2 Indirect Process Data Channel

Indirect process data is data that does not remain constant while the device is in operation, and changes depending on external events or requirements. Process data identifiers (PD index) are used to determine the structure of this data. The handshake between both communication partners is defined using a status/control byte.

### 6.8.2.3 Parameter Channel

In addition to the process data channel, the parameter channel allows an FMS-like background communication to be carried out. In this context, the bytes of a saved log are sequentially transferred via the INTERBUS. This process is usually advantageous for slower communication processes where larger data volumes are being used, and it does not delay the equidistant transfer of time-critical data.

## 6.8.3 Connecting the Operating Device

In the INTERBUS, the operating device is run in the indirect process data channel. Neither the parameter channel nor the direct process data channel is used. The user data is interpreted in accordance with the MMICOM profile.

The connection to the bus is implemented using dc-decoupled RS485 drivers. The actual bus protocol is handled by the INTERBUS protocol chip.

On the controller side, a manufacturer-specific INTERBUS master controller board is required, preferably with dc-decoupling.

If the controller board in the controller has an 8-wire remote bus interface (25 pin), use the bus terminal IBS 24 BK/LC2 to convert to the 2-wire remote bus (9 pin).

Both the INTERBUS connection and the MMICOM protocol are independent of the controller. As a result, only variable numbers and no real controller addresses are transferred in the MMICOM protocol. The variable number is referenced to the variable in the controller.

A function block must be called in the controller's main program. This function block is assigned the parameters for the location of the IN and OUT data, and must be called for each connected operating device. If necessary, the function block interpretes the requests received from the operating device. In this context, either a read or a write function is carried out, which makes the assignment between the variable number and the actual controller variable. If necessary, the data is copied in the controller in an event-controlled manner. As a result, the controller has a say in what data is written and read by the operating device.

All services (requests) required to run the operating device originate in the operating device. The operating device has client functionality. The controller only reacts to the requests of the operating device, and therefore fulfils the functions of a server.

### 6.8.3.1 Specification for INTERBUS

The following parameters are used to run operating devices on the INTERBUS:

| Parameter | | Value |
|---|---|---|
| Width of the Data Channel | Indirect Process Data with Status Word | 4 Words / 8 Bytes |
| | Direct Process Data | None |
| | Parameter Channel | None |
| Identcode | PD Channel with Input and Output Data | $2F_h$ / $47_d$ |
| Function group specification within the MMICOM | B3 | Variable Input |
| | G1 | Variable Request |
| MMICOM Services Used | PD-Index 0x14 | Write Variable 1 Byte (Mandatory) |
| | PD-Index 0x15 | Write Variable 2 Bytes (Mandatory) |
| | PD-Index 0x16 | Write Variable 4 Bytes |
| | PD-Index 0x40 | Read Variable 1 Byte (Mandatory) |
| | PD-Index 0x41 | Read Variable 2 Bytes (Mandatory) |
| | PD-Index 0x42 | Read Variable 4 Bytes |
| | PD-Index 0x84 | Write Bit to Byte |
| | PD-Index 0x85 | Write Bit to Word |

Fig. 6-166: Parameters for the operating devices on the INTERBUS

## 6.8.4 Programming

### 6.8.4.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### MMICOM Handshake Timeout

This parameter specifies how long the operating device waits for an acknowledgement from the controller.

| Configurable Values | Default Value |
|---|---|
| 0 ms to 65535 ms | 100 ms |

Fig. 6-167: MMICOM handshake timeout

#### Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

| Configurable Values | Default Value |
|---|---|
| 0 s to 20 s | 10 s |

Fig. 6-168: Delay until connection set-up

#### Floating Point Number in the Siemens Format

This parameter specifies whether floating point numbers are exchanged in the Siemens-specific format or IEEE format.

| Configurable Values | Default Value |
|---|---|
| IEEE Format | |
| Siemens Format | X |

Fig. 6-169: Floating point number in the Siemens format

### 6.8.4.2 Additional Functions

Only accesses up to four bytes are supported in the MMICOM profile. You must therefore use several accesses to implement the system parameters **polling area**and **status messages**.

To achieve a defined byte order, you must always use 2-byte accesses to implement the system parameters. Always select the access W (word) when assigning the start-up variable number.

## Poll Area

The polling area is used to manage the write coordination byte (WCB), the serial message channel and the LEDs in the function keys. This area is continuously polled by the operating device. The polling area is structured as follows:

| **Bit Number** | **15** | **8** | **7** | **0** |
|---|---|---|---|---|
| Variable X | WCB | | Reserved | |
| Variable X+1 | Serial Message Channel High Byte | | Serial Message Channel Low Byte | |
| Variable X+2 | LED 1 to 4 | | LED 5 to 8 | |
| Variable X+3 | LED 9 to 12 | | LED 13 to 16 | |
| Variable X+4 | LED 17 to 20 | | LED 21 to 24 | |
| Variable X+5 | LED 25 to 28 | | LED 29 to 32 | |

Fig. 6-170: Additional function - polling area, MMICOM

## Status Messages

Status messages are the static assignment of flags (bits) in the controller to plain text messages in the operating device.

The area for the status messages has the following structure:

| **Bit Number** | **15** | **8** | **7** | **0** |
|---|---|---|---|---|
| Variable X | Message 16 to 9 | | Message 8 to 1 | |
| Variable X+1 | Message 32 to 25 | | Message 24 to 17 | |
| Variable X+2 | Message 48 to 41 | | Message 40 to 33 | |

Fig. 6-171: Status messages, MMICOM

### 6.8.4.3 Data Types

The data types specify how many bytes are assigned to a single variable.

| Data Type | Access to | Length of Single Variable | Comment |
|---|---|---|---|
| BY | Byte (and Bit also) | 1 Byte | Next Byte is Located 1 Address Higher |
| W | Word | 2 Bytes | Next Word is Located 1 Address Higher |
| W-2 | Word | 2 Bytes | Next Word is Located 2 Address Higher |
| DW | Double Word | 4 Bytes | Next Double Word is Located 1 Address Higher |
| DW-2 | Double Word | 4 Bytes | Next Double Word is Located 2 Address Higher |
| DW-4 | Double Word | 4 Bytes | Next Double Word is Located 4 Address Higher |

Fig. 6-172: Data types, MMICOM

The access parameter determines the data length that is evaluated by the operating device, and the MMICOM service used to handle the variable.

The following convention applies to data with a data length of more than 4 bytes (for example, alphanumeric texts, tables, polling area, status messages):
Depending on the access type, the data is processed with the corresponding one-, two-, or four-byte access. If there is other data to be processed, it is assumed that this data is located under the next higher variable number in each case.

**For example:** A text with ten characters that starts at the variable 100 (access W - word) is made up of the variables 100 to 104.

## 6.8.4.4 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

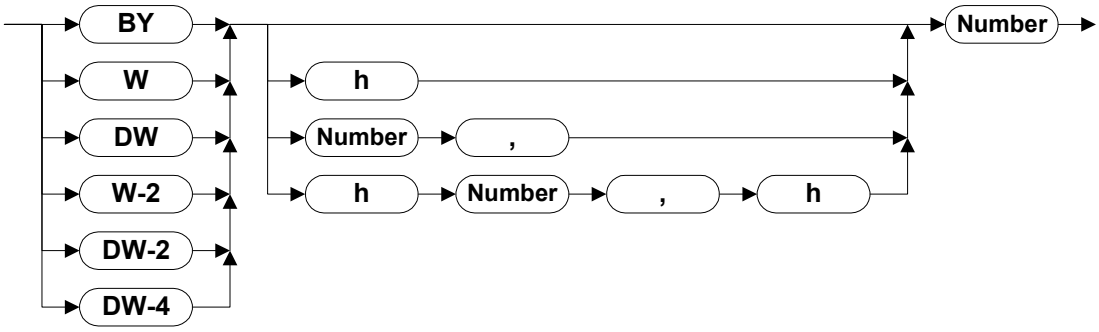



Fig. 6-173: Syntax diagram

Variable addresses written with a comma are decoded as follows:

Variable address = Figure 1 (high-byte) x 25610 + figure 2 (low-byte)

You can enter figure 1 and figure 2 as a decimal or hexadecimal, but you must use each to the same base (for example, DW16,16 or DWh10,h10).

### Variable Number

The MMICOM profile is used to assign the data on a controller-independent basis, based on a variable number. A fixed controller address is only assigned to a variable number in the controller (for example, the variable number 50 will be assigned to the flag 32.0). The variable number can either be entered as a decimal (without an ID) or as a hexadecimal (with a leading h).

**Example** Variable number 100 or H64

A linear, ascending variable number area must be reserved for data structures greater than 4 bytes (for example, alphanumeric texts, tables, polling area, status messages). This number area must be determined by the size of the data structure and the access used in each case.

When you start up the operating device, a one-byte read access is carried out on the variable with the number zero. In this context, the data read is not interpreted, and the read function block does not have to decode this variable number.

## 6.8.5 Physical Interfacing

### 6.8.5.1 Pin Assignment

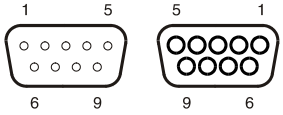



Fig. 6-174: 9 pin D-SUB male connector strip and female connector strip

Connector in the terminal: 9 pin D-SUB male connector strip for remote bus in.

| Pin | Designation | Function |
|---|---|---|
| 1 | DO | Data Output |
| 2 | DI | Data Input |
| 3 | GND | Ground |
| 4 | nc | Not Connected |
| 5 | nc | Not Connected |
| 6 | /DO | Data Output, Inverted |
| 7 | /DI | Data Input, Inverted |
| 8 | nc | Not Connected |
| 9 | nc | Not Connected |

Fig. 6-175: Pin assignment remote bus in (INTERBUS)

Connector in the terminal: 9 pin D-SUB female connector strip for remote bus out.

| Pin | Designation | Function |
|---|---|---|
| 1 | DO | Data Output |
| 2 | DI | Data Input |
| 3 | GND | Ground |
| 4 | nc | Not Connected |
| 5 | +5 V | Power Supply +5 VDC |
| 6 | /DO | Data Output, Inverted |
| 7 | /DI | Data Input, Inverted |
| 8 | nc | Not Connected |
| 9 | RBST | Remote Bus Status |

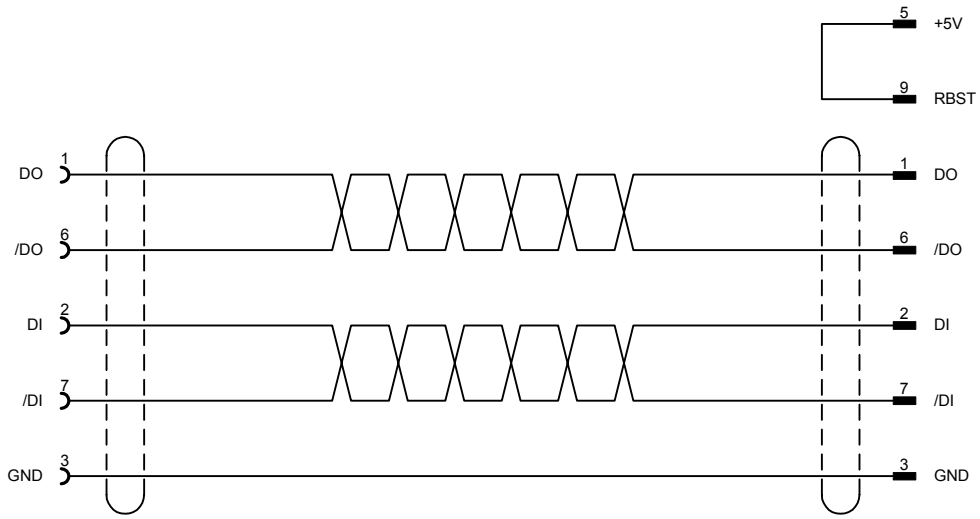
Fig. 6-176: Pin assignment remote bus out (INTERBUS)

INTERBUS MMICOM raw

## 6.8.5.2 2-Wire Remote Bus Cable

Operating device
Remote bus IN

Remote bus OUT




D-SUB
male connector
9 pin

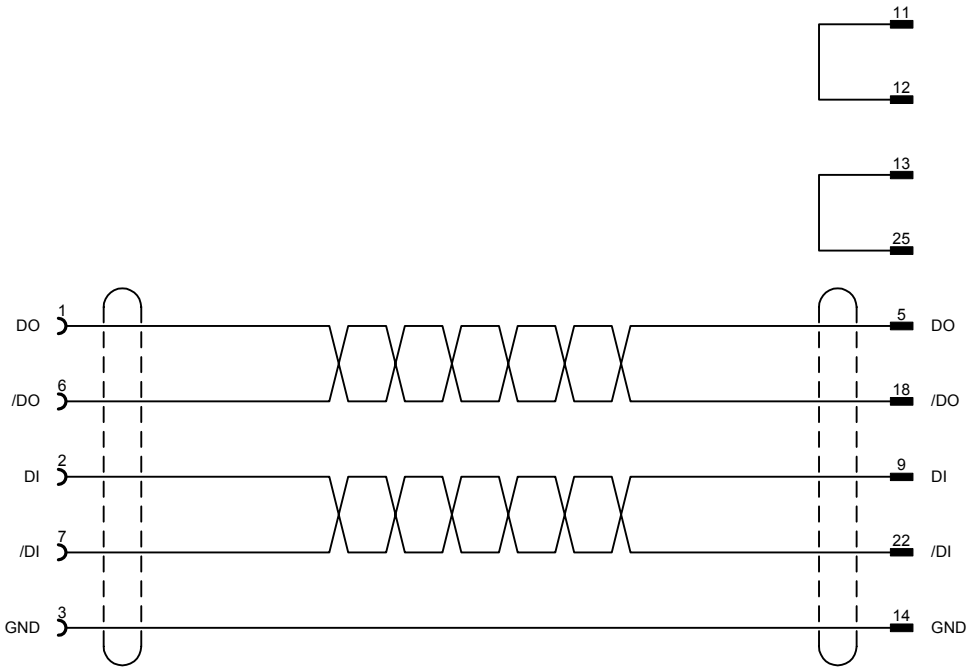
D-SUB
male connector
9 pin

INTERBUS MMICOM raw

## 6.8.5.3 Converting from 8-Wire Protocol to 2-Wire Protocol

Operating device
Remote bus IN

Remote bus OUT




D-SUB
male connector
9 pin

D-SUB
male connector
9 pin

INTERBUS MMICOM raw

## 6.8.6 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 2 | | The controller has transferred data to the operating device, but the operating device has not requested the data. The subcode specifies the received PD index in decimal format. | |
| 40 | | Illegal system variable. | The project contains an illegal system variable. |
| 50 | | Malfunction bit not set by controller.The subcode specifies the received PD Index in decimal format. | |
| 51 | | Online bit not set by controller.The subcode specifies the received status control byte in decimal format. | Bus is not running, PLC program is missing or controller is in STOP mode. |
| 52 | | Standard bit and/or index bit not set by controller.The subcode specifies the received status control byte in decimal format. | Bus is not running, PLC program is missing or controller is in STOP mode. |
| 53 | | Wrong PD index received. The subcode specifies the received PD Index in decimal format. | |
| 54 | | Handshake error (receive timeout). The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | PLC program is missing or controller is in STOP mode or the function block for the operating device is not active. |
| 55 | | Handshake error (send timeout). The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | PLC program is missing or controller is in STOP mode. |
| 56 | | Variable has wrong base size. The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | Wrong access type specified. |
| 57 | | Handshake error. The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | Handshake bits were not set correctly by controller. |

Fig. 6-177: Error Messages - MMICOM

INTERBUS MMICOM raw

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 58 | | Access error. The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | No valid data cycles are executed on the INTERBUS. |
| 59 | | Wrong variable number received. The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | The 8 byte user data are not consistent. There is an error within the controller board. |
| 60 | | Wrong PD index received. The subcode specifies the received PD Index in decimal format. | The 8 byte user data are not consistent. There is an error within the controller board. |

Fig. 6-177: Error Messages - MMICOM

By setting up the following system variables in one of the masks in the projects, you can log the error messages with the operating device.

- **ComParityCount** to log the number of the error codes 59.
- **ComOverrunCount** to log the number of the error codes 60.
- **ComFrameCount** to log the number of all other error codes.

## 6.9 PROFIBUS-DP raw

Profibus DP provides a manufacturer- and controller-independent data transmission protocol. The Profibus DP is a speed-optimized Profibus variant that is specially tailored to communication between programmable controllers and decentralized peripheral devices.

Profibus DP is implemented in the operating device and meets the requirements of parts 1 and 3 of the German standard DIN 19245. It also corresponds to the European field bus standard EN 50170.

As the operating device fulfills standardization requirements, it can be successfully integrated as a slave into the Profibus DP.

All operating devices can be linked using an integrated Profibus DP additional module. You can also link several operating devices to one master controller.

The entire PROFIBUS DP protocol is handled by the protocol chip SPC3. Transfer speeds of up to 12 MBaud are possible.

The operating device is used in the bus as a decentralized module that occupies up to 256 inputs and outputs. The size can be programmed from between 8- and 32-byte IN data, and between 8- and 32-byte OUT data. Data transfer is carried out via the peripheral area.

The input/output image is exchanged cyclically between the master and operating device via the bus. In this context, the operating device uses the cyclical input/output image for data exchange between the master and the slave. The data content to be interpreted is defined for both partners in a data profile.

All services required for running the operating device originate in the operating device. The operating device has client functions.

The controller reacts to the requests of the operating device. It has server functions.

The master module must interpret the incoming data according to the profile and also respond according to the profile. This is carried out using a function block in the controller that is able to interpret the requests in the IN data, and write a response to the OUT data.

### 6.9.1 Specification for PROFIBUS-DP

The specification of the operating device in PROFIBUS DP is defined using the device data base (GSD) file RX01081A.GSD.

#### 6.9.1.1 Diagnosis

The operating device implements the station-related diagnosis.

5-byte user diagnosis data is transferred

- 1st byte = error number (1 = communication error in the operating device)
- 2nd and 3rd byte communication error code
- 4th and 5th byte communication error subcode

The communication-error code and subcode are the values that are also displayed on the operating device.

### 6.9.2 Data Profile

To allow direct data access to the different data areas in a controller, a data profile must be agreed between the master and the slave.

The first four bytes of the telegram length set are used as follows:

- Telegram sequential number and length
- Definition of the access
- Definition of the data area

PROFIBUS-DP raw

### 6.9.2.1 Structure of the Data Profile

## Request Telegram

| Byte | Content | |
|---|---|---|
| 1 | Number of user data, sequential number of telegram | |
| 2 | Access | |
| 3 | Offset (Depends on Byte Order Setting) | Low (High) |
| 4 | | High (Low) |
| 5 | User Data 1st Byte | |
| 6 | User Data 2nd Byte | |
| n | User Data nth Byte | |

Fig. 6-178: Request telegram

**Byte 1** Number of User Data

| Bit | Content |
|---|---|
| 0 | Number of User Data in Byte.Specifies the number of bytes for the user data transfer. |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | Sequential Number of the Telegram.Identification number for each communication process.<br>(0 = initialization cycle, 1 - 7 = normal sequential number) |
| 6 | |
| 7 | |

Fig. 6-179: Number of User Data

PROFIBUS-DP raw

**Byte 2** Access

| Bit | Content |
|---|---|
| 0 | Byte Number<br>For Word Access 0 = First Byte, 1 = Second Byte |
| 1 | Reserved |
| 2 | |
| 3 | |
| 4 | |
| 5 | Access:<br>00 = Bit<br>01 = Byte<br>02 = Word<br>03 = Double Word |
| 6 | |
| 7 | Data Direction:<br>0 = Read<br>1 = Write |

Fig. 6-180: Access

**Bytes 3 and 4** These bytes contain the address for accessing a data area.

**Byte 5 ff** The user data are located from byte 5 onwards to the end of the telegram.

## Response Telegram

| Byte | Content | |
|---|---|---|
| 1 | Number of User Data | |
| 2 | Access | |
| 3 | Return Code | Error |
| 4 | | 0x00 |
| 5 | User Data 1st Byte | |
| 6 | User Data 2nd Byte | |
| n | User Data nth Byte | |

Fig. 6-181: Response telegram

## User Data

The user data are located from byte 5 onwards to end of the telegram.

## Reading and Writing Bytes

Depending on the telegram length and access, up to 28 bytes of user data can be transferred during reading and writing operations.

When bytes are being read and written, the user data appears in the telegram as of byte five.

## Reading Bits

When the system reads bits, it reads a byte, word or double word, based on the address width of the data area to be read.

The operating device masks out the requested bits, and displays the data in line with the display settings.

## Writing Bits

Only an individual bit is set or deleted.

The controller receives a bit mask and link information from the operating device via the request telegram. The bit is set or deleted in the target address using the bit mask and the link information.

The byte order of the bit mask for word addresses is oriented to the protocol parameters specified for the byte order.

| Byte | Content |
|---|---|
| 5 | Bit Mask |
| 6 | Logical Operation<br>0 = AND<br>1 = OR |

Fig. 6-182: Writing to a byte address

| Byte | Content |
|---|---|
| 5 | Bit Mask LOW |
| 6 | Bit Mask HIGH |
| 7 | Logical Operation<br>0 = AND<br>1 = OR |

Fig. 6-183: Writing to a word address

PROFIBUS-DP raw

## 6.9.3 Programming

### 6.9.3.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### Maximum Waiting Time for Response

Set a period of time that the operating device will wait for a response from the controller. If the operating device does not receive a response in this period, it will issue an error message.

| Configurable Values | Default Value |
|---|---|
| 1 ms to 65535 ms | 1000 ms |

Fig. 6-184: Maximum waiting time for response, PROFIBUS-DP

#### Delay Until Connection Set-Up

This value specifies the time delay after which the operating device starts the first connection setup.

| Configurable Values | Default Value |
|---|---|
| 1000 ms to 65535 ms | 5000 ms |

Fig. 6-185: Delay until connection setup, PROFIBUS-DP

#### Station Number

Specifies the station number of the operating device within the PROFIBUS-DP structure. The station numbers 0 to 2 are reserved.

| Configurable Values | Default Value |
|---|---|
| 3 to 124 | 3 |

Fig. 6-186: Station number, PROFIBUS-DP

## Telegram Length

The telegram length is set in the PROFIBUS configuration. Specify the same value in the PROFIBUS programming software.

| Configurable Values | Default Value |
|---|---|
| 8 bytes to 32 bytes | 20 bytes |

Fig. 6-187: Telegram length, PROFIBUS-DP

## Floating Point Format

Enter the interpretation form for floating point numbers. This is also the setting for a timer and counter in the Siemens DCS format.

| Configurable Values | Default Value |
|---|---|
| Siemens Format | |
| IEEE Format | X |

Fig. 6-188: Floating point format, PROFIBUS-DP

## Byte Order

Specify the byte order for word and double-word addresses. (Siemens = High-Low, Bosch = Low-High)

| Configurable Values | Default Value |
|---|---|
| Low-High | X |
| High-Low | |

Fig. 6-189: Byte order, PROFIBUS-DP

## Address Width

Specify the address width you want the operating device to use when accessing controller addresses.

| Configurable Values | Default Value |
|---|---|
| 1 = Byte Address | |
| 2 = Word Address | X |
| 4 = Double-Word Address | |

Fig. 6-190: Address width, PROFIBUS-DP

### 6.9.3.2 System Parameters

## Poll Area

Limits applying to the poll area:

- The variable must be word-oriented.
- The area must be contiguous.
- The controller must be able to access this area in bit-mode.
- The operating device must be able to access this area in word-mode.

See chapter „Word-Oriented Polling Area“ on page 5-126.

PROFIBUS-DP raw

## 6.9.4 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

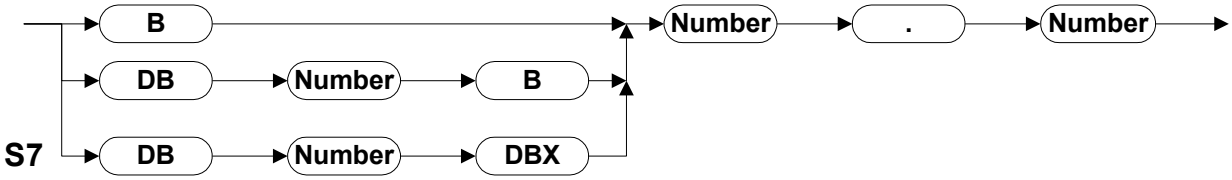



Fig. 6-191: Syntax diagram for bit access, PROFIBUS-DP.

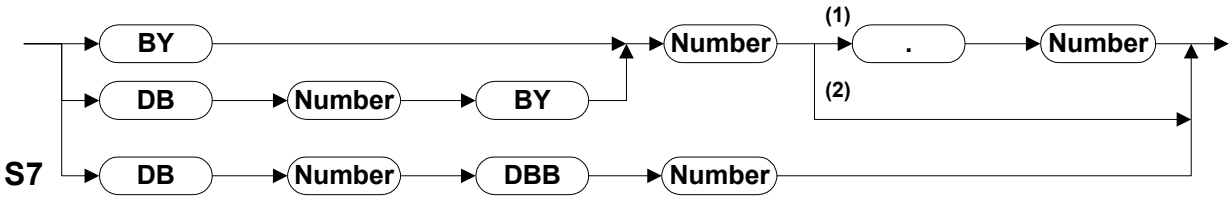



Fig. 6-192: Syntax diagram for byte access, PROFIBUS-DP.

**1** The number in front of the point is a word or double-word address. The number after the point specifies the byte number within the word/double word.

**2** The number in front of the point is a byte address.

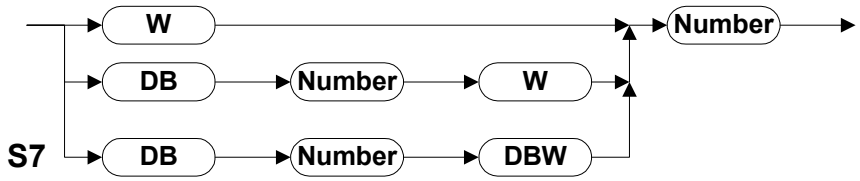



Fig. 6-193: Syntax diagram for word access, PROFIBUS-DP.

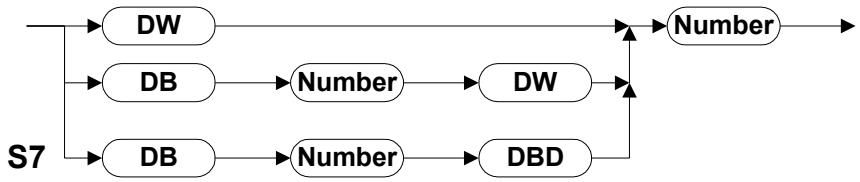



Fig. 6-194: Syntax diagram for double-word access, PROFIBUS-DP

PROFIBUS-DP raw

## 6.9.5 Physical Interfacing

### 6.9.5.1 Pin Assignment

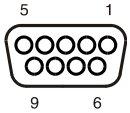



Fig. 6-195: 9-pin D-SUB female connector strip

Connector in the small operator terminal: 9-pin D-SUB female connector strip

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | nc | Not Connected |
| 3 | RxD/TxD-P | Received Data / Transmitted Data Plus |
| 4 | CNTR-P | Repeater Control Signal Plus |
| 5 | DGND | Data Transmission Potential |
| 6 | VP | Supply Voltage of Terminators Plus |
| 7 | nc | Not Connected |
| 8 | RxD/TxD-N | Received Data / Transmitted Data Minus |
| 9 | CNTR-N | Repeater Control Signal Minus |

Fig. 6-196: Pin assignment PROFIBUS DP

The D-SUB connector strips must be shielded sufficiently. See chapter „Shielding D-SUB Connectors“ on page 7-1.

### 6.9.5.2 Cable X2 - PROFIBUS-DP

In the wiring depicted below, the potential difference between the data reference potentials DGND of all connections are NOT to exceed +/- 7 V.

Ensure that no compensating current flow through the bus cable shield. Install a separate equipotential bonding conductor.

PROFIBUS-DP raw

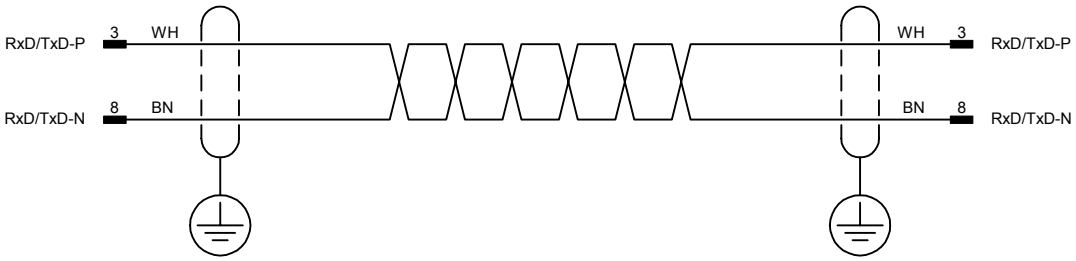



Fig. 6-197: Connecting cable PROFIBUS-DP

There are two cable specifications for PROFIBUS-FMS and PROFIBUS-DP:

| Parameter | Cable type A | Cable type B |
|---|---|---|
| Wave Impedance | 135 to 165 Ohm (for f = 3 to 20 MHz) | 100 to 135 Ohm (for f > 100 MHz |
| Cable capacity | < 30 pF/m | < 60 pF/m |
| Wire cross-section | > 0.34 mm2 | > 0.22 mm2 |
| Loop Impedance | < 110 Ohm/km | --- |
| Signal attentuation | max. 9 dB | max. 9 dB |
| Cable type | twisted-pair 1 x 2 / 2 x 2 / 1 x 4 wires | twisted-pair1x 2 / 2 x 2 / 1 x 4 wires |
| Shielding | Copper braided shielding or braided shielding + foil shielding | Copper braided shielding or braided shielding + foil shielding |

Fig. 6-198: Cable specification for PROFIBUS

## Transfer Speed and Line Length

With the PROFIBUS, data can be transferred using different transfer speeds. However, the higher the transfer speed, the shorter the maximum permitted line length. The values listed in the following table apply to the cable type A which is more closely specified in DIN E 19245 part 3.

| Baud Rate (Bit/s) | Line Length (m) |
|---|---|
| 187 500 | 1000 |
| 500 000 | 400 |
| 1 500 000 | 200 |
| 3 000 000 | 100 |
| 6 000 000 | 100 |
| 12 000 000 | 100 |

Fig. 6-199: Transfer speed versus line length for PROFIBUS

## 6.9.6 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | | |
| | 1 | Slave is currently not ready | |
| | 2 | Packets out of sequence | |
| | 3 | Protocol framing error | |
| | 4 | Timeout | |
| | 5 | CRC error | |
| | 6 | Parity error | |
| | 7 | Send process aborted | |
| | 8 | Receive process aborted | |
| | 9 | Buffer too small for cyclic data | |
| | 10 | No cyclic data defined | |
| | 12 | Cyclic data already defined | |
| | 15 | The selected protocol is not supported | |
| | 16 | Receive buffer overrun | |
| | 40 | Undefined system variable | |
| 50 | | Error initializing the SPC3 | |
| | 1 | Buffer too large | |
| | 2 | No initialization of SPC3 | |
| | 4 | No memory for telegram buffer | |
| 60 | | No configuration from master | |
| 61 | | Wrong input length | |
| 62 | | Wrong output length | |
| 63 | | Error in configuration data, reparameterization required | |

Fig. 6-200: Error Messages for PROFIBUS-DP

PROFIBUS-DP raw

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 64 | | Protocol chip requires configuration update, re-parameterization required. | |
| 65 | | No communication via protocol chip, reparameterization required. | |
| 66 | | Protocol chip reset, reparameterization required. | |
| 67 | | Watchdog time error, reparameterization required. | |
| 70 | | Operating device is not polled | |
| | 0 | Distinguishing feature for manufacturer | |
| | 1 | Distinguishing feature for manufacturer | |
| 71 | xxx | No response to order.<br>xxx = variable number | |
| 100 | | Base no. for error from PLC function block. PLC error is added to 100. The subcode indicates the offset value for the access, during which the error occurred. | |
| | z.B. 102 | Access to DB via FB111 / FB112 DB does not exist | |

Fig. 6-200: Error Messages for PROFIBUS-DP

PROFIBUS-DP raw

## 6.9.7 Applications

The controller program, which is usually a function block, must handle the requests of the operating device in line with the data profile.

The details depend on the controller. The following sections explain the controller-specific applications that have been developed to date.

The device data base (GSD) file RX01081A.GSD can be used to set the parameters of the operating devices in the PLC software. This file is available in a subdirectory of the programming software and in our Internet download area.

### 6.9.7.1 Rexroth Controllers

The PLC program communicates with the PROFIBUS DP via the input/output peripheral area.

Each participant, including each operating device in the PROFIBUS DP, is assigned an IN and OUT data channel.

The channel is assigned using the parameterization of the Bosch controller's PROFIBUS DP master module. The module MP-DP12 is used in Bosch controllers.

#### Configuration in IndraLogic

**Library IL_VCP_DP.lib**

For PROFIBUS communication with the small operator terminal library IL_VCP_DP must be inserted in the IndraLogic programming interface. Then, the following function blocks are available:

- VCP_PBS16_A4096 (with a data capacity of 16 bytes)
- VCP_PBS32_A4096 (with a data capacity of 32 bytes)
- VCP_PB32_A65536 (with a data capacity of 32 bytes)

After inserting a communication block you must globally declare the following variables in the PLC program for every instance:

```
<Var.-name> AT %IB<Address of the VCP in Str.konf.> ARRAY[0..<(data capacity of VCP)-1>]OF BYTE
<Var.-name> AT %QB<Address of the VCP in Str.konf.>  ARRAY[0..<(data capacity of VCP)-1>]OF BYTE
<Var.-name> ARRAY[0..4096] OF BYTE or
<Var.-name> ARRAY[0..65536] OF BYTE when block VCP_PB32_A65536 is used.
```

PROFIBUS-DP raw

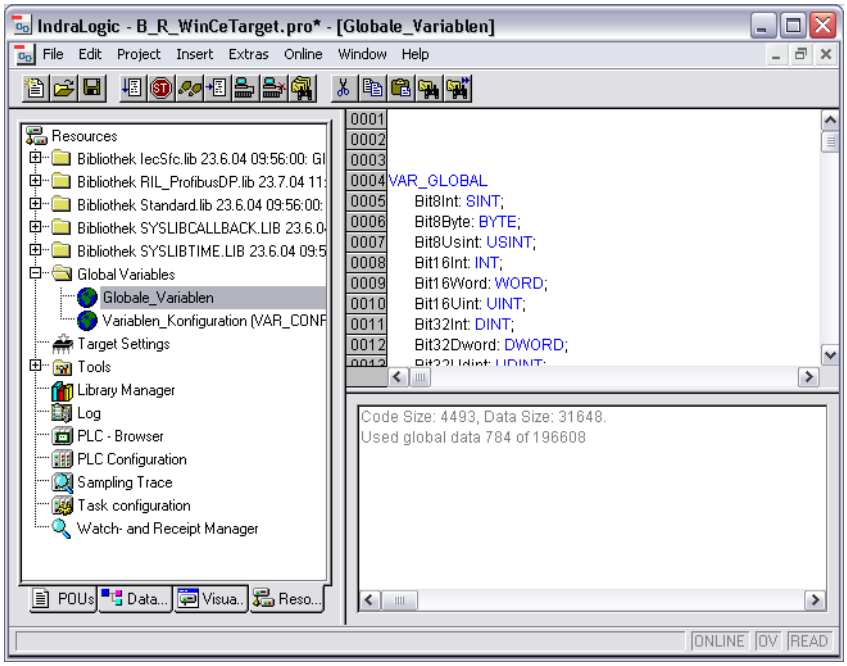



Fig. 6-201: Variable declaration to insert the communication FBs

## Description of the Function Blocks

The function blocks activate the Profibus DP protocol for the small operator terminals VCPxx. Additionally, the I/O image of the physical addresses between PLC and operator terminal is generated.

The data capacity of the data transmission depends on the used function block and is 16 or 32 bytes. The seize of the address area available via an ARRAY is 4096 or 65536 bytes (inputs and output included).

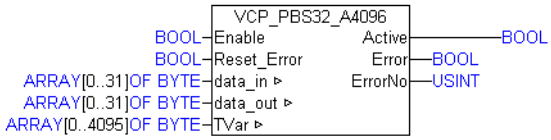



Fig. 6-202: Example function block VCP_PBS32_A4096

| | Name | Type | Comment |
|---|---|---|---|
| VAR_IN | Enable | BOOL | TRUE FB is executed<br>FALSE: FB is not executed |
| | Reset_Error | BOOL | TRUE: Reset of "Error" (to FALSE) and "ErrorNo" is set to 0 |
| VAR_IN_OUT | Data_in | ARRAY OF BYTE [0..15] or<br>ARRAY OF BYTE [0..31] | Data to connect the physical inputs of the small operator terminal. |
| | Data_out | ARRAY OF BYTE [0..15] or<br>ARRAY OF BYTE [0..31] | Data to connect the physical outputs of the small operator terminal. |
| | TVar | ARRAY OF BYTE [0..4096] or<br>ARRAY OF BYTE [0..65535] | Array to read from and write on the operator terminal. |
| VAR_OUT | Active | BOOL | TRUE, as long as "Enable" is also TRUE. |
| | Error | BOOL | TRUE, when an error occurs.<br>Can be reset with "Reset-Error". |
| | ErrorNo | USINT | Error type:<br>4: Calculation error |

Fig. 6-203: Interface of the function blocks

**VI-Composer**

During the configuration with the Rexroth VI Composer the addresses of the variable list refer to the respective byte in array "TVar", that is used in the PLC program to exchange data.

**Error Handling**

As soon as an error occurs, the communication is interrupted and the display of the small operator terminal indicates "COMMUNICATION ERROR, ERROR CODE 110".

The error type (ErrorNo) indicates that the error is an address calculation error (CalculationError).

## Configuration in WINSPS

**Evaluation of the control bytes in the PLC Program:**

The PLC program must cyclically poll the peripheral area that is assigned to the operating device. Using the sequential number, it must check whether a new request has been received from the operating device. In addition, bytes 1 and 2 must be copied, unchanged, from the request telegram to the response telegram, and 0x00 must be written to byte 3.

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You require the following modules for this task. They are contained in a subfolder of the programming software's installation folder.

| Controller | Function Block |
|---|---|
| CL200 | ..\FBs\Profibus\BOSCH\WINSPS\CL200\BT_PB2.pxl |
| CL300 | ..\FBs\Profibus\BOSCH\WIN-SPS\CL345\BT_PB345.pxl |
| CL400 | ..\FBs\Profibus\BOSCH\WIN-SPS\CL345\BT_PB345.pxl |
| CL500 | ..\FBs\Profibus\BOSCH\WIN-SPS\CL345\BT_PB345.pxl |
| SoftPLC | ..\FBs\Profibus\BOSCH\WINSPS\PLC\BT_PBPLC.pxl |

Fig. 6-204: Function blocks for the programming software WINSPS

**Error Handling in the PLC Program:**

Errors can be entered in the return code, byte 4 of the response telegram. If no error occurs, byte 4 must be deleted. Possible errors are:

- DB does not exist.

**Function Blocks Supplied:**

You must configure the operating device as the slave using 'n Byte kons. Daten E/A' (n byte cons. data I/O) in the DP master module.

If you are using interrupts, you must save the scratch flags and the four registers used in the interrupt OB.

**Inserting the Library Files in WINSPS**:

1. Start WinSPS.
2. Copy the corresponding pxl file to the ZSO directory of the PLC project.

You can only copy the file to the appropriate project directory as modules of the incorrect controller type are not recognized!

3. Assign the library in the toolbar.

**Example:**

```
FC10, R BT_PB345
```

4. Open the editor in the PLC software.

**Example:** OB1

Select the PROFIBUS block from the 'Edit/Parameter list' menu.

**Parameterizing the call-up function:**

**Example:** For two operating devices:

```
...
;DEF für Gerät 1
DEF 10,-EZ_Basisn
DEF 10,-AZ_Basisn
DEF DB50,-DBNR
DEF 0,-WDNR
DEF 20,-TLNG
;DEF für Gerät 2
DEF 10,-EZ_Basisn2
DEF 10,-AZ_Basisn2
DEF DB50,-DBNR2
DEF 0,-WDNR2
DEF 20,-TLNG2
;Aufruf Gerät 1
BA -BT_345,5 FC10
P0 W -EZ_Basisn
P1 W -AZ_Basisn
P2 -DBNR
P3 W -WDNR
P4 W -TLNG
;Aufruf Gerät 1
BA -BT_345,5 FC10
P0 W -EZ_Basisn2
P1 W -AZ_Basisn2
P2 -DBNR2
P3 W -WDNR2
P4 W -TLNG2
...
```

**Function Block BT_PB345**:

The function block BT_DP345 is used to decode the transfer protocol of the operating devices. It ensures consistent data transfer.

When you program the controller, note that a total of 64 bytes as of the address DB[P2] W[P3] are reserved for processing the protocol. Other program components cannot use this area!

The function block BT_PB345 uses the following parameters:

| Parameter | Function |
|---|---|
| P0 | EZ Base Address |
| P1 | AZ Base Address |
| P2 | Data block for storing the EZ/AZ data |
| P3 | Base Address in Data Block [P2] |
| P4 | Telegram Length<br>corresponds to the number of EZ/AZ data of the slave configuration (8, 12, 16, 20, 28, or 32 bytes) |

Fig. 6-205: Parameters for function block BT_PB345

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## Configuration in PROFI

| Controller | Function Block |
|---|---|
| CL200 | ..\FBs\Profibus\BOSCH\PROFI\CL200\BT_MAIN.PBO<br>..\FBs\Profibus\BOSCH\PROFI\CL200\BT_READ.PBO<br>..\FBs\Profi-bus\BOSCH\PROFI\CL200\BT_WRITE.PBO<br>..\FBs\Profibus\BOSCH\PROFI\CL200\OB1.PBO |
| CL300 | ..\FBs\Profibus\BOSCH\PROFI\CL350400/ BT_MAIN.PCO<br>..\FBs\Profi-bus\BOSCH\PROFI\CL350400\BT_READ.PCO<br>..\FBs\Profi-bus\BOSCH\PROFI\CL350400\BT_WRITE.PCO<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\OB1.PCO |
| CL400 | ..\FBs\Profibus\BOSCH\PROFI\CL350400/ BT_MAIN.PCO<br>..\FBs\Profi-bus\BOSCH\PROFI\CL350400\BT_READ.PCO<br>..\FBs\Profi-bus\BOSCH\PROFI\CL350400\BT_WRITE.PCO<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\OB1.PCO |
| CL500 | ..\FBs\Profibus\BOSCH\PROFI\CL500/BT_MAIN.P5O<br>..\FBs\Profi-bus\BOSCH\PROFI\CL350400\BT_READ.P5O<br>..\FBs\Profi-bus\BOSCH\PROFI\CL350400\BT_WRITE.P5O<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\OB1.P5O |

Fig. 6-206: Function blocks for the programming software PROFI

### Function Block BT_MAIN

Structure of the block:

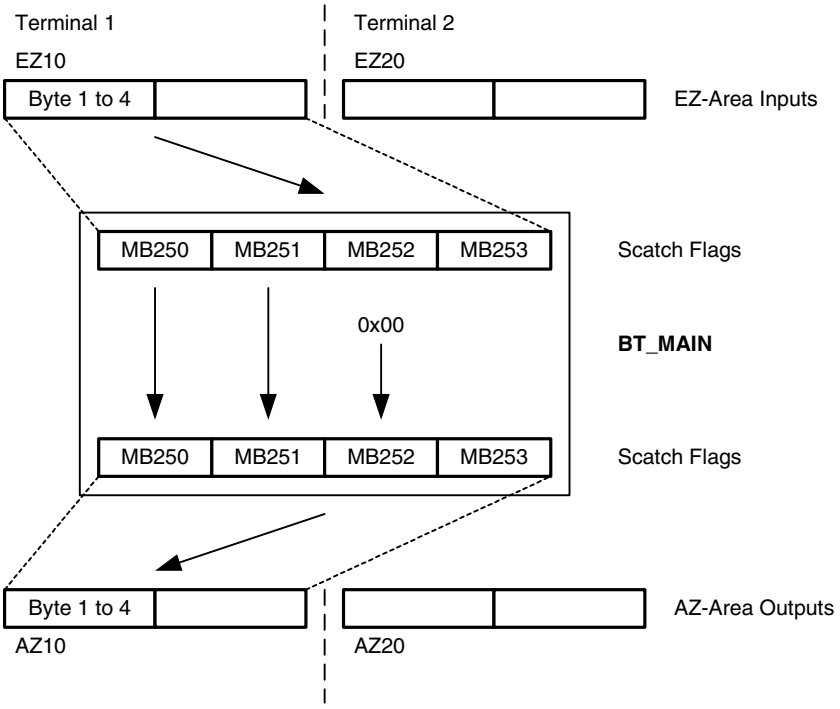


Fig. 6-207: Structure of the BT_MAIN

### Function Block BT_MAIN Call-Up

**Example:** Call-up in OB1

```
;OB1 Organisationsbaustein
;**************************************
;Profibus-DP-Koomunikation mit Bediengerät
;Beispiel zur Einbindung im OB1
;**************************************
;Befehle notwendig für Profibus
L W EZ2,A ;Adresse muss mit Koppeladresse übereinstimmen
T W A,AZ2 ;nur für CL400
;Einmal pro Bediengerät aufrufen
BA -BT_MAIN,4 ;Aufruf für das erste Bediengerät
; +---+
P0 W K10 ; < ! Adresse des Eingangsbereichs
P1 W K10 ; < ! Adresse des Ausgangsbereichs
P2 W DB0 ; < ! Nummer des Datenbausteins
P3 W D0 ; < ! Datenwortnummer
; +---+
PE
```

### Function Block BT_READ

The function block BT_READ interprets the subsequent bytes in the telegram as follows:

– Byte 2, bit 0 is interpreted as a byte code for a byte access to a word address.

| Value | Meaning |
|---|---|
| 0 | Odd Address - Low Byte |
| 1 | Even Address - High Byte |

Fig. 6-208: Byte code in byte 2

– Byte 3 contains the data block number.
– Byte 4 contains the data word number within the DB.

The program module doubles the data word number for the even-numbered byte number in the DB.

### Function Block BT_WRITE

The function block BT_WRITE interprets the subsequent bytes in the telegram as follows:

– Byte 2, bit 0 is interpreted as a byte code for a byte access to a word address.

| Value | Meaning |
|---|---|
| 0 | Odd Address - Low Byte |
| 1 | Even Address - High Byte |

Fig. 6-209: Byte code in byte 2

– Byte 3 contains the data block number within the DB.
– Byte 4 contains the data word number within the DB (0 to 255).
– Byte 5 and
– Byte 6 contain the bit mask for the logical operation.
– Byte 7 contains the logical instruction (AND / OR).

### Parameterization of the BM-DP12 Module

Set the parameters for the module using the Bosch DP software.

The device data base (GSD) file RX01081A.GSD which is supplied is directly read in by the DP software. This means that the data required to set the parameters of the operating devices are automatically available.

Select the operating device with the required data width.

The function block copies bytes 1 and 2, unchanged, from the request telegram to the response telegram, and writes 0x00 to byte 3.

The function block uses MW248 to MW254 as scratch flags.

For each operating device, the program block also requires any data word of a data block. The data word is transferred as a parameter during the call. The telegram sequential number is saved in this data word.

The function block cyclically checks the content of byte 1 – bits 5 to 7.

If the value 0 is contained here, the telegram number memory is reset.

If in byte 1, bits 5 to 7 are not equal to the content of the telegram number memory, a new request telegram has been received from the operating device, and this must be evaluated and a response sent.

The function block is called cyclically in OB1 with the corresponding parameters for each operating device.

## Protocol Parameters for BM DP12

Set the following parameters for the protocol:

| Parameter | Value |
|---|---|
| Maximum Waiting Time for Response [ms] | 1000 |
| Delay Until Connection Set-Up [ms] | 5000 |
| Station Number | 3 |
| Telegram Length | 16 |
| Floating Point Number in the Siemens Format | Inactive |
| Byte Order is High-Low | Inactive |
| Address Width | 2 |

Fig. 6-210: Protocol parameters for the Bosch CL series

Set the parameters using the Bosch DP software. The supplied device data base file RX01081A.GSD is directly imported by the DP software. Therefore, the data required to set the parameters of the operating devices are available in the DP software. You can specify 8, 12, or 16 bytes for the telegram length.

## Protocol Parameters for the Bosch CL Series

Set the following parameters for the protocol:

| Parameter | Value |
|---|---|
| Maximum Waiting Time for Response [ms] | 1000 |
| Delay Until Connection Set-Up [ms] | 5000 |
| Station Number | 3 |
| Telegram Length | 20 |
| Floating Point Number in the Siemens Format | Inactive |
| Byte Order is High-Low | Inactive |
| Address Width | 2 |

Fig. 6-211: Protocol parameters for the Bosch CL series

## Defining Variables

Specify the variable addresses in either the hexadecimal notation or using the following syntax formats:

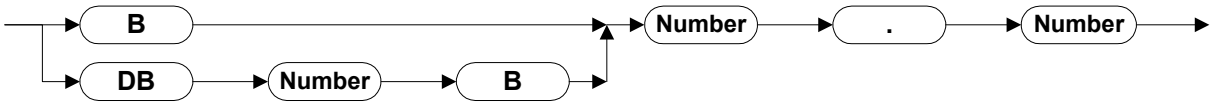


Fig. 6-212: Bit access for PROFIBUS using the Bosch CL series

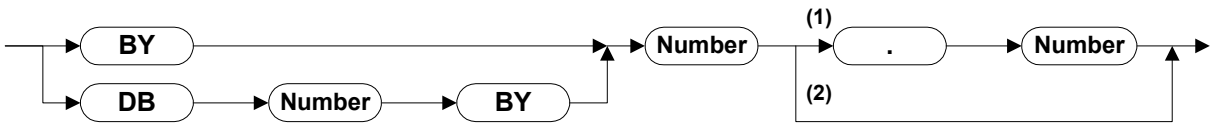


Fig. 6-213: Byte access for PROFIBUS using the Bosch CL series

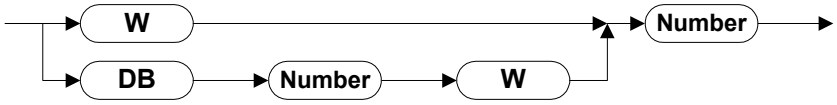


Fig. 6-214: Word access for PROFIBUS with the Bosch CL series

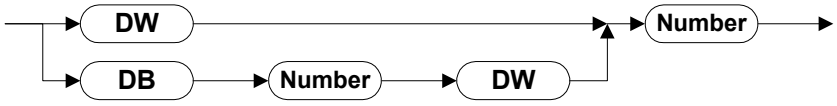


Fig. 6-215: Double-word access for PROFIBUS using the Bosch CL series

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In the variable list of the programming software, you can also enter the addresses in hexadecimal notation:

| Variable Name | Address (hex) | Low-Bit | High-Bit | PLC Access | PLC Address |
|---|---|---|---|---|---|
| Var1 | DW H124B | | | Double Word | DB18 D150 to D153 |
| Var2 | W H124B | | | Word | DB18 D150 and D151 |
| Var3 | BY H124B | | | Byte | DB18 D151 |
| Var4 | BY H124B | 1 | 1 | Bit | DB18 D150 Bit 5 |
| Var5 | B H124B | 13 | 13 | Bit | DB18 D151 Bit 5 |

Fig. 6-216: Hexadecimal notation for addresses

# 7 Shielding D-SUB Connectors

You must shield D-SUB connectors as follows:

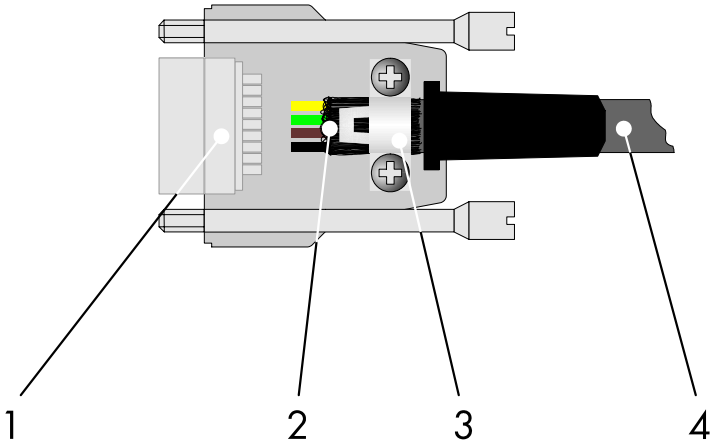


Fig. 7-1: Shielding D-SUB connectors

**1** D-SUB connector
**2** Shield
**3** Cable clip
**4** Cable

The shield must be folded back into a flat position over the cable sheath.

When fastening the cable with the cable clip, as much of the shielding as possible must be in contact with the housing and sufficient strain relieve must be ensured.

Shielding D-SUB Connectors

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Service & Support

# 10 Service & Support

## 10.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

- telefonisch - by phone: **49 (0) 9352 40 50 60**
  über Service Call Entry Center Mo-Fr 07:00-18:00
  - via Service Call Entry Center Mo-Fr 7:00 am - 6:00 pm
- per Fax - by fax: **+49 (0) 9352 40 49 41**
- per e-Mail - by e-mail: **service.svc@boschrexroth.de**

## 10.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

After helpdesk hours, contact our service department directly at

**+49 (0) 171 333 88 26**

oder - or **+49 (0) 172 660 04 06**

## 10.3 Internet

Unter **www.boschrexroth.com** finden Sie ergänzende Hinweise zu Service, Reparatur und Training sowie die **aktuellen** Adressen *) unserer auf den folgenden Seiten aufgeführten Vertriebs- und Servicebüros.

☐ Verkaufsniederlassungen
☐ Niederlassungen mit Kundendienst

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit unserem für Sie nächstgelegenen Ansprechpartner auf.

*) Die Angaben in der vorliegenden Dokumentation können seit Drucklegung überholt sein.

At **www.boschrexroth.com** you may find additional notes about service, repairs and training in the Internet, as well as the **actual** addresses *) of our sales- and service facilities figuring on the following pages.

☐ sales agencies
☐ offices providing service

Please contact our sales / service office in your area first.

*) Data in the present documentation may have become obsolete since printing.

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## 10.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

1. detaillierte Beschreibung der Störung und der Umstände.
2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel.-/Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

For quick and efficient help, please have the following information ready:

1. Detailed description of the failure and circumstances.
2. Information on the type plate of the affected products, especially type codes and serial numbers.
3. Your phone/fax numbers and e-mail address, so we can contact you in case of questions.

## 10.5 Kundenbetreuungsstellen - Sales & Service Facilities

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| Czech Republic - Tschechien<br>Bosch -Rexroth, spol.s.r.o.<br>Hviezdoslavova 5<br>627 00 Brno<br>Tel.: +420 (0)5 48 126 358<br>Fax: +420 (0)5 48 126 112 | Czech Republic - Tschechien<br>DEL a.s.<br>Strojírenská 38<br>591 01 Zdar nad Sázavou<br>Tel.: +420 566 64 3144<br>Fax: +420 566 62 1657 | Hungary - Ungarn<br>Bosch Rexroth Kft.<br>Angol utca 34<br>1149 Budapest<br>Tel.: +36 (1) 422 3200<br>Fax: +36 (1) 422 3201 | Poland – Polen<br>Bosch Rexroth Sp.zo.o.<br>ul. Staszica 1<br>05-800 Pruszków<br>Tel.: +48 22 738 18 00<br>– service: +48 22 738 18 46<br>Fax: +48 22 758 87 35<br>– service: +48 22 738 18 42 |
| Poland – Polen<br>Bosch Rexroth Sp.zo.o.<br>Biuro Poznan<br>ul. Dabrowskiego 81/85<br>60-529 Poznan<br>Tel.: +48 061 847 64 62 /-63<br>Fax: +48 061 847 64 02 | Romania - Rumänien<br>East Electric S.R.L.<br>Bdul Basarabia no.250, sector 3<br>73429 Bucuresti<br>Tel./Fax:: +40 (0)21 255 35 07<br>+40 (0)21 255 77 13<br>Fax: +40 (0)21 725 61 21<br>eastel@rdsnet.ro | Romania - Rumänien<br>Bosch Rexroth Sp.zo.o.<br>Str. Drobety nr. 4-10, app. 14<br>70258 Bucuresti, Sector 2<br>Tel.: +40 (0)1 210 48 25<br>+40 (0)1 210 29 50<br>Fax: +40 (0)1 210 29 52 | Russia - Russland<br>Bosch Rexroth OOO<br>Wjatskaja ul. 27/15<br>127015 Moskau<br>Tel.: +7-095-785 74 78<br>+7-095 785 74 79<br>Fax: +7 095 785 74 77<br>laura.kanina@boschrexroth.ru |
| Russia - Russland<br>ELMIS<br>10, Internationalnaya<br>246640 Gomel, Belarus<br>Tel.: +375/ 232 53 42 70<br>+375/ 232 53 21 69<br>Fax: +375/ 232 53 37 69<br>elmis_ltd@yahoo.com | Turkey - Türkei<br>Bosch Rexroth Otomasyon<br>San & Tic. A..S.<br>Fevzi Cakmak Cad No. 3<br>34630 Sefaköy Istanbul<br>Tel.: +90 212 541 60 70<br>Fax: +90 212 599 34 07 | Turkey - Türkei<br>Servo Kontrol Ltd. Sti.<br>Perpa Ticaret Merkezi B Blok<br>Kat: 11 No: 1609<br>80270 Okmeydani-Istanbul<br>Tel: +90 212 320 30 80<br>Fax: +90 212 320 30 81<br>remzi.sali@servokontrol.com<br>www.servokontrol.com | Slowenia - Slowenien<br>DOMEL<br>Otoki 21<br>64 228 Zelezniki<br>Tel.: +386 5 5117 152<br>Fax: +386 5 5117 225<br>brane.ozebek@domel.si |

Service & Support

## 10.5.4 Afrika, Asien, Australien (inkl. Pazifischer Raum) - Africa, Asia, Australia (incl. Pacific Rim)

| | | | |
|---|---|---|---|
| Australia - Australien<br>AIMS - Australian Industrial Machinery Services Pty. Ltd.<br>28 Westside Drive<br>Laverton North Vic 3026<br>Melbourne<br>Tel.: +61 3 93 14 3321<br>Fax: +61 3 93 14 3329<br>**Hotlines:** +61 3 93 14 3321<br>+61 4 19 369 195<br>enquires@aimservices.com.au | Australia - Australien<br>Bosch Rexroth Pty. Ltd.<br>No. 7, Endeavour Way<br>Braeside Victoria, 31 95<br>Melbourne<br>Tel.: +61 3 95 80 39 33<br>Fax: +61 3 95 80 17 33<br>mel@rexroth.com.au | China<br>Shanghai Bosch Rexroth Hydraulics & Automation Ltd.<br>Waigaoqiao, Free Trade Zone<br>No.122, Fu Te Dong Yi Road<br>Shanghai 200131 - P.R.China<br>Tel.: +86 21 58 66 30 30<br>Fax: +86 21 58 66 55 23<br>richard.yang_sh@boschrexroth.com.cn<br>gf.zhu_sh@boschrexroth.com.cn | China<br>Shanghai Bosch Rexroth Hydraulics & Automation Ltd.<br>4/f, Marine Tower<br>No.1, Pudong Avenue<br>Shanghai 200120 - P.R.China<br>Tel: +86 21 68 86 15 88<br>Fax: +86 21 58 40 65 77 |
| China<br>Bosch Rexroth China Ltd.<br>15/F China World Trade Center<br>1, Jianguomenwai Avenue<br>Beijing 100004, P.R.China<br>Tel.: +86 10 65 05 03 80<br>Fax: +86 10 65 05 03 79 | China<br>Bosch Rexroth China Ltd.<br>Guangzhou Repres. Office<br>Room 1014-1016, Metro Plaza,<br>Tian He District, 183 Tian He Bei Rd<br>Guangzhou 510075, P.R.China<br>Tel.: +86 20 8755-0030<br>+86 20 8755-0011<br>Fax: +86 20 8755-2387 | China<br>Bosch Rexroth (China) Ltd.<br>A-5F., 123 Lian Shan Street<br>Sha He Kou District<br>Dalian 116 023, P.R.China<br>Tel.: +86 411 46 78 930<br>Fax: +86 411 46 78 932 | China<br>Melchers GmbH<br>BRC-SE, Tightening & Press-fit<br>13 Floor Est Ocean Centre<br>No.588 Yanan Rd. East<br>65 Yanan Rd. West<br>Shanghai 200001<br>Tel.: +86 21 6352 8848<br>Fax: +86 21 6351 3138 |
| Hongkong<br>Bosch Rexroth (China) Ltd.<br>6th Floor,<br>Yeung Yiu Chung No.6 Ind Bldg.<br>19 Cheung Shun Street<br>Cheung Sha Wan,<br>Kowloon, Hongkong<br>Tel.: +852 22 62 51 00<br>Fax: +852 27 41 33 44<br>alexis.siu@boschrexroth.com.hk | India - Indien<br>Bosch Rexroth (India) Ltd.<br>Electric Drives & Controls<br>Plot. No.96, Phase III<br>Peenya Industrial Area<br>Bangalore – 560058<br>Tel.: +91 80 51 17 0-211...-218<br>Fax: +91 80 83 94 345<br>+91 80 83 97 374<br>mohanvelu.t@boschrexroth.co.in | India - Indien<br>Bosch Rexroth (India) Ltd.<br>Electric Drives & Controls<br>Advance House, II Floor<br>Ark Industrial Compound<br>Narol Naka, Makwana Road<br>Andheri (East), Mumbai - 400 059<br>Tel.: +91 22 28 56 32 90<br>+91 22 28 56 33 18<br>Fax: +91 22 28 56 32 93<br>singh.op@boschrexroth.co.in | India - Indien<br>Bosch Rexroth (India) Ltd.<br>S-10, Green Park Extension<br>New Delhi – 110016<br>Tel.: +91 11 26 56 65 25<br>+91 11 26 56 65 27<br>Fax: +91 11 26 56 68 87<br>koul.rp@boschrexroth.co.in |
| Indonesia - Indonesien<br>PT. Bosch Rexroth<br>Building # 202, Cilandak Commercial Estate<br>Jl. Cilandak KKO, Jakarta 12560<br>Tel.: +62 21 7891169 (5 lines)<br>Fax: +62 21 7891170 - 71<br>rudy.karimun@boschrexroth.co.id | Japan<br>Bosch Rexroth Automation Corp.<br>Service Center Japan<br>Yutakagaoka 1810, Meito-ku,<br>NAGOYA 465-0035, Japan<br>Tel.: +81 52 777 88 41<br>+81 52 777 88 53<br>+81 52 777 88 79<br>Fax: +81 52 777 89 01 | Japan<br>Bosch Rexroth Automation Corp.<br>Electric Drives & Controls<br>2F, I.R. Building<br>Nakamachidai 4-26-44, Tsuzuki-ku<br>YOKOHAMA 224-0041, Japan<br>Tel.: +81 45 942 72 10<br>Fax: +81 45 942 03 41 | Korea<br>Bosch Rexroth-Korea Ltd.<br>Electric Drives and Controls<br>Bongwoo Bldg. 7FL, 31-7, 1Ga<br>Jangchoong-dong, Jung-gu<br>Seoul, 100-391<br>Tel.: +82 234 061 813<br>Fax: +82 222 641 295 |
| Korea<br>Bosch Rexroth-Korea Ltd.<br>1515-14 Dadae-Dong, Saha-gu<br>Electric Drives & Controls<br>Pusan Metropolitan City, 604-050<br>Tel.: +82 51 26 00 741<br>Fax: +82 51 26 00 747<br>eunkyong.kim@boschrexroth.co.kr | Malaysia<br>Bosch Rexroth Sdn.Bhd.<br>11, Jalan U8/82, Seksyen U8<br>40150 Shah Alam<br>Selangor, Malaysia<br>Tel.: +60 3 78 44 80 00<br>Fax: +60 3 78 45 48 00<br>hockhwa@hotmail.com<br>rexroth1@tm.net.my | Singapore - Singapur<br>Bosch Rexroth Pte Ltd<br>15D Tuas Road<br>Singapore 638520<br>Tel.: +65 68 61 87 33<br>Fax: +65 68 61 18 25<br>sanjay.nemade<br>@boschrexroth.com.sg | South Africa - Südafrika<br>TECTRA Automation (Pty) Ltd.<br>71 Watt Street, Meadowdale<br>Edenvale 1609<br>Tel.: +27 11 971 94 00<br>Fax: +27 11 971 94 40<br>**Hotline:** +27 82 903 29 23<br>georgv@tectra.co.za |
| Taiwan<br>Bosch Rexroth Co., Ltd.<br>Taichung Branch<br>1F., No. 29, Fu-Ann 5th Street,<br>Xi-Tun Area, Taichung City<br>Taiwan, R.O.C.<br>Tel : +886 - 4 -23580400<br>Fax: +886 - 4 -23580402<br>charlie.chen@boschrexroth.com.tw<br>jim.lin@boschrexroth.com.tw<br>david.lai@boschrexroth.com.tw | Thailand<br>NC Advance Technology Co. Ltd.<br>59/76 Moo 9<br>Ramintra road 34<br>Tharang, Bangkhen,<br>Bangkok 10230<br>Tel.: +66 2 943 70 62<br>+66 2 943 71 21<br>Fax: +66 2 509 23 62<br>Hotline +66 1 984 61 52<br>sonkawin@hotmail.com | | |

Service & Support

## 10.5.5 Nordamerika - North America

| USA<br>Headquarters - Hauptniederlassung | USA Central Region - Mitte | USA Southeast Region - Südwest | **USA SERVICE-HOTLINE** |
|---|---|---|---|
| Bosch Rexroth Corporation<br>Electric Drives & Controls<br>5150 Prairie Stone Parkway<br>Hoffman Estates, IL 60192-3707<br>Tel.: +1 847 6 45 36 00<br>Fax: +1 847 6 45 62 01<br>servicebrc@boschrexroth-us.com<br>repairbrc@boschrexroth-us.com | Bosch Rexroth Corporation<br>Electric Drives & Controls<br>Central Region Technical Center<br>1701 Harmon Road<br>Auburn Hills, MI 48326<br>Tel.: +1 248 3 93 33 30<br>Fax: +1 248 3 93 29 06 | Bosch Rexroth Corporation<br>Electric Drives & Controls<br>Southeastern Technical Center<br>3625 Swiftwater Park Drive<br>Suwanee, Georgia 30124<br>Tel.: +1 770 9 32 32 00<br>Fax: +1 770 9 32 19 03 | - 7 days x 24hrs -<br>**+1-800-REX-ROTH**<br>**+1 800 739 7684** |
| USA East Region – Ost | USA Northeast Region – Nordost | USA West Region – West | |
| Bosch Rexroth Corporation<br>Electric Drives & Controls<br>Charlotte Regional Sales Office<br>14001 South Lakes Drive<br>Charlotte, North Carolina 28273<br>Tel.: +1 704 5 83 97 62<br>+1 704 5 83 14 86 | Bosch Rexroth Corporation<br>Electric Drives & Controls<br>Northeastern Technical Center<br>99 Rainbow Road<br>East Granby, Connecticut 06026<br>Tel.: +1 860 8 44 83 77<br>Fax: +1 860 8 44 85 95 | Bosch Rexroth Corporation<br>7901 Stoneridge Drive, Suite 220<br>Pleasant Hill, California 94588<br>Tel.: +1 925 227 10 84<br>Fax: +1 925 227 10 81 | |
| Canada East - Kanada Ost | Canada West - Kanada West | Mexico | Mexico |
| Bosch Rexroth Canada Corporation<br>Burlington Division<br>3426 Mainway Drive<br>Burlington, Ontario<br>Canada L7M 1A8<br>Tel.: +1 905 335 5511<br>Fax: +1 905 335 4184<br>**Hotline:** +1 905 335 5511<br>michael.moro@boschrexroth.ca | Bosch Rexroth Canada Corporation<br>5345 Goring St.<br>Burnaby, British Columbia<br>Canada V7J 1R1<br>Tel. +1 604 205 5777<br>Fax +1 604 205 6944<br>**Hotline:** +1 604 205 5777<br>david.gunby@boschrexroth.ca | Bosch Rexroth Mexico S.A. de C.V.<br>Calle Neptuno 72<br>Unidad Ind. Vallejo<br>07700 Mexico, D.F.<br>Tel.: +52 55 57 54 17 11<br>Fax: +52 55 57 54 50 73<br>mariofelipe.hernandez@boschrexroth.com.mx | Bosch Rexroth S.A. de C.V.<br>Calle Argentina No 3913<br>Fracc. las Torres<br>64930 Monterrey, N.L.<br>Tel.: +52 81 83 65 22 53<br>+52 81 83 65 89 11<br>+52 81 83 49 80 91<br>Fax: +52 81 83 65 52 80<br>mario.quiroga@boschrexroth.com.mx |

## 10.5.6 Südamerika - South America

| Argentina - Argentinien | Argentina - Argentinien | Brazil - Brasilien | Brazil - Brasilien |
|---|---|---|---|
| Bosch Rexroth S.A.I.C.<br>"The Drive & Control Company"<br>Rosario 2302<br>B1606DLD Carapachay<br>Provincia de Buenos Aires<br>Tel.: +54 11 4756 01 40<br>+54 11 4756 02 40<br>+54 11 4756 03 40<br>+54 11 4756 04 40<br>Fax: +54 11 4756 01 36<br>+54 11 4721 91 53<br>victor.jabif@boschrexroth.com.ar | NAKASE<br>Servicio Tecnico CNC<br>Calle 49, No. 5764/66<br>B1653AOX Villa Balester<br>Provincia de Buenos Aires<br>Tel.: +54 11 4768 36 43<br>Fax: +54 11 4768 24 13<br>**Hotline:** +54 11 155 307 6781<br>nakase@usa.net<br>nakase@nakase.com<br>gerencia@nakase.com (Service) | Bosch Rexroth Ltda.<br>Av. Tégula, 888<br>Ponte Alta, Atibaia SP<br>CEP 12942-440<br>Tel.: +55 11 4414 56 92<br>+55 11 4414 56 84<br>Fax sales: +55 11 4414 57 07<br>Fax serv.: +55 11 4414 56 86<br>alexandre.wittwer@rexroth.com.br | Bosch Rexroth Ltda.<br>R. Dr.Humberto Pinheiro Vieira, 100<br>Distrito Industrial [Caixa Postal 1273]<br>89220-390 Joinville - SC<br>Tel./Fax: +55 47 473 58 33<br>Mobil: +55 47 9974 6645<br>prochnow@zaz.com.br |
| Columbia - Kolumbien | | | |
| Reflutec de Colombia Ltda.<br>Calle 37 No. 22-31<br>Santafé de Bogotá, D.C.<br>Colombia<br>Tel.: +57 1 368 82 67<br>+57 1 368 02 59<br>Fax: +57 1 268 97 37<br>reflutec@neutel.com.co<br>reflutec@007mundo.com | | | |

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